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WAYS AND MEANS OF PREVENTING AND MINIMIZING SURGICAL INFECTIONS

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INTRODUCTION

Ever since the time of Lister's most active labors, now just a decade less than a century ago, surgeons have been interested in discovering ways and means of preventing and minimizing, as well as controlling and eliminating, surgical infections. Such discovery concerns itself (1) with finding out the sources from which come the bacteria which get into the body and produce surgical infections; (2) with closing the portals of entry for those bacteria; (3) with providing an unfavorable environment for their growth within the body; and (4) with building up the defenses within the body which oppose their establishment and multiplication.

It is interesting to recall, although it is a sad commentary on the intelligence of the surgical profession, that it took almost a quarter of a century for the surgeons to acknowledge the validity of Lister's contentions and follow his precepts. After these were accepted and followed, the minutiae of sterile technic were slowly and painstakingly developed until about 15 years ago when it seemed that the incidence of infection in operative wounds had been brought down to the irreducible minimum. Such an incidence in well regulated operating rooms did not exceed 1 to 2 per cent in clean wounds and 10 to 12 per cent in wounds contaminated at the time of operation by bacterial normally present within the body. Infection in wounds contaminated *before* operation, such as accidental wounds due to street accidents, compound fractures or burns, might have an incidence of 25 to 50 per cent, depending on the time interval between the accident and surgical treatment as well as on the primary surgical toilet and subsequent dressings.

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During the last 15 years a whole series of new antibacterial agents has become available, which if properly used should have reduced the incidence and severity of surgical infections to lower levels, particularly in the last two categories of patients, namely, those contaminated at the time of operation and those contaminated before the time of operation.

The anticipated benefit from the systemic and local use of the sulfonamides in the prevention of infection, failed to materialize, probably because they were inactivated by the proteoses and peptones and certain acids produced at the site of injury. However, the early antibiotics, represented by penicillin, bacitracin, streptomycin and terramycin, were not so inactivated and their use as adjuncts to careful sterile technic had the effect of reducing the percentage of infections in all of the three categories of surgical operations mentioned above. In recent years, however, there have been definite indications that the incidence of infections is mounting again in many surgical clinics. Let us see if we can find out whether this is so and if it is, let us find out why and apply some measures to correct it.

In this connection certain questions might be asked and certain answers suggested:

1. Do you know the incidence of infection in your own private practice and in the general run of staff as well as private patients in the hospitals upon whom you operate?
2. Are you forgetting or neglecting to follow conscientiously all of the minutiae of sterile technic which have been developed over the course of years?
3. Does your operating staff have a "sterile conscience" as well as a "sterile sense" which recognizes at once a break in sterile technic and corrects it immediately?
4. Are you depending on the newer antibacterial agents to make up for deficiencies or breaks in your sterile technic?
5. Are you using the newer antibacterial agents intelligently or indiscriminately?

The answer to the first question is that you cannot know the incidence of infections simply by your impression. You must have someone keep track of the course of wound healing from week to week, scrutinize and analyze each and every record, and note the incidence of both trivial and serious wound infections with cultures to determine the causative organisms and their sensitivities. This should be done in every clinic. The staff will thereby be made "infection conscious" and each one will make every effort to reduce his score.

The answers to the second, third and fourth questions can be given by anyone who watches the operating personnel perform their duties—the masking, the scrub-up of hands, the preparation of the operative field, and the various steps in the operative procedure. The chief operator himself is responsible for the technic of every member of the operating team and should, by precept and example, hold fast to the highest standards. At the same time the junior members of the team and the nurses assisting with the patient should feel free to call attention to any break by the operator himself and be thanked and commended for alertness in doing so.

Sterile technic must also be applied to daily dressings performed by the doctor with the aid of a nurse or other attendant at the bedside of the patient. Anyone who watches a dressing can quickly note whether bacteria are allowed to enter or are prevented from entering the wound by the persons involved, including the patient himself.

The answer to the fifth question is, that there is altogether too much indiscriminate use of the newer antibacterial agents in almost every hospital. Although Henry Welch, Director of the Division of Antibiotics of the Food and Drug Administration, has said that we are entering a new era of antibiotic therapy, namely, the combined use of antibiotics, there is too much "shotgun" therapy without regard to the requirements of the patient as determined by adequate laboratory studies and without regard to the proper methods of administration. Each of you will doubtless know whether this applies to your own practice or to your associates' in the hospitals where you work.

In surgical infections, a determination of the sensitivities of all of the organisms involved is of prime importance, first, because many surgical infections are polymicrobial and, second, because many organisms, especially those of the staphylococcal groups, have become resistant to many of the antibiotics in common use.

RECENT SURVEY OF SURGICAL INFECTIONS AT JACKSON MEMORIAL HOSPITAL

Not long ago the authors were asked to make a survey of infections developing in staff patients operated upon at the Jackson Memorial Hospital in Miami, Florida. If such a study was to be worthwhile, it seemed necessary (1) to make observations on the sterile technic in the operating rooms, (2) to determine the extent of air contamination in the operating rooms, (3) to check the presence or absence of the carrier state of pathogenic organisms among the operating personnel, (4) to observe the technic of dressings on the wards, and (5) to review the sterilizing processes in the central supply room.

First of all it was necessary to find out the incidence, severity and nature of these infections. In a preliminary review of the patients on one of the services over a period of a few months, it was found that 10 per cent of clean cases had become infected. In the patients contaminated at the time of operation by organisms within the body, the incidence of infection was 22.5 per cent. In the patients contaminated before the operation (street accidents, etc.) 23.9 per cent became infected.

An attempt was made to determine the source of the infection by a close scrutiny of the onset and course of the infection and of the bacteriologic findings. This clinical and laboratory review indicated that in about one quarter of the infections occurring in the clean cases, the contamination almost certainly occurred in the operating room. In another quarter, it might have occurred either in the operating room or at the time of subsequent dressings. In another quarter, it might have occurred either in the operating room or through lymphatics draining neighboring contaminated areas of the body. In the last quarter, the contamination took place almost certainly at the time of postoperative dressings.

Among the patients contaminated at the time of operation, the cultures and the clinical course seemed to indicate that in the great majority of the infections, the contamination came almost certainly from the gastrointestinal tract. The others for the most part seemed to have been contaminated by organisms dropping on the sterile field in the operating room.

Among the patients who were contaminated before coming to the operating room infection developed in almost 25 per cent. The contamination in half of these patients came from contiguous areas in the body and in the other half, the principal organisms were almost certainly introduced from the outside at the time of accident.

A study of the procedures in the central supply room, including the autoclaves with their self-recording thermometers, seemed to rule out contamination from the supplies and instruments. Blood agar plates exposed in the operating room yielded an unexpectedly low colony count when the operating rooms were not in use but considerably more during operations.

Cultures of the noses and throats of the members of the operating personnel revealed the fact that almost 50 per cent were carriers of pathogenic microorganisms, mostly penicillin-resistant staphylococci. This seemed to represent one of the chief sources of contamination in clean cases, if not the major source. Furthermore, it was noted that certain of the doctors failed to mask the nose as well as the mouth during the operation. In most instances the masks worn were quite permeable to smoke and other particles much larger than bacteria. In fact, if the masks were held up to the light, there were many apertures through which the light could readily be seen.

Observations in the operating rooms of various surgical procedures failed to reveal any flagrant departures from accepted sterile technic. There were some variations in the length of the scrub-up time both for the hands and arms of the operating personnel, but breaks in the technic were not observed.

Many faults were found in the technic of ward dressings, particularly the dressing of open wounds. Often exudate could be seen coming through inadequate dressings, indicating that organisms were being spread extensively around the patient's environment and probably were being picked up on the hands and clothing of the patient, the nurses, the doctors and other attendants. Thus the organisms could be readily transferred to the nose and throat and could then establish a carrier state.

For ward dressings it was noted that the doctors seldom used masks or gloves. Dressings were often removed and applied with the hands rather than with instruments, and dressings were sometimes contaminated before being applied to the wounds. Often not sufficient care was used in the transfer of dressings, syringes, needles and other instruments from the central supply to the hands of the doctor doing the dressing.

These observations indicated that all of the doors were not being properly closed to the entrance of contaminating bacteria into operative wounds and sterile technic needed tightening up all along the line.

The records also revealed the fact that not enough use was being made of the bacteriology laboratory to determine the contaminating or the infecting organisms at the earliest time, so as to permit either prophylactic or curative measures to be applied with the utmost speed. Even in many cases of frank infection no material had been taken for culture. This often led to the indiscriminate and unwise use of the antibiotics and other antibacterial agents.

The high incidence of postoperative infection could not be attributed to any single factor. No one person could be held responsible for it.

An attempt was made to check the carriers of pathogens with the development of infection in the patient operated upon by those carriers, but no certain correlation could be demonstrated. However, there is very little doubt that they contributed to the distribution of pathogenic organisms in the operating rooms and throughout the hospital. The high incidence of carriers suggested that an attempt might be made to reduce the number of these pathogenic organisms or to rid the carrier entirely of them.

Undoubtedly similar conditions can be found in many of the hospitals and clinics served by members of the Southeastern Surgical Congress. This is a matter of great importance, for infection not only frequently results in prolonged illness with much temporary or permanent disability or even death, but in those who survive, the ordeal produces a more or less profound disturbance of the economic stability of the patient.

RECOMMENDATIONS FOR LOWERING THE INCIDENCE OF OPERATIVE WOUND INFECTIONS

It is important that *every member* of the surgical staff keep constantly in mind his responsibility for minimizing the entrance of bacteria into the area of operation before, during, and after the operative procedure itself. This includes: his contact with and handling of accident patients from the time they enter the hospital; the preparation of the patient and particularly of the area of operation before the operation itself; the adequate masking of both nose and mouth by everyone entering the operating room; the conscientious scrubbing of hands before operation; the "sterile sense" and "sterile conscience," which notes and corrects any break in technic during the operative procedure; the careful handling of dressings on the wards and in the clinic with adequate masking when open wounds are dressed; the proper use of instruments and gloves when they are called for; the taking of cultures and close contact with the bacteriology laboratory giving significant clinical details, so that the proper media and culture methods will be employed and the appropriate sensitivity tests used, and then to obtain early preliminary laboratory reports; and last but not least, the prompt and intelligent use of the appropriate antibiotics based upon the laboratory studies.

With regard to the operating room itself, no person should enter the operating room at any time in street clothes or shoes or without wearing a mask covering both nose and mouth. All persons entering or leaving the operating room should

do so by way of the scrub rooms. The doors to the operating room opening on a corridor should be used only for bringing the patient in and out of the room. All persons entering the operating room should have their shoes covered with muslin or canvas covers. Helmets covering the head except for the eyes are preferable to simple caps. Four-ply masks of fine mesh with an impermeable plastic, cotton or flannel lining should be used to cover both the nose and the mouth. All members of the operating team, as well as anesthetists, circulating nurses and orderlies, should be masked at all times while in the operating room. Masks should not be removed after any operation until the person has left the operating room. Surgeons and other personnel with upper respiratory infections should not be in the operating room. If it is mandatory that they be present under such conditions, they should wear two masks and double the normal scrub-up time. The carrier state in operating room personnel might be rendered less dangerous or be eliminated by the frequent spraying of both nose and throat with bacitracin and neomycin solution. Both of these antibiotics are bactericidal and are synergistic with one another. Both have a very low allergenic action.

Powder for the hands of the operating team and nurses should be applied before the individual is gowned. Powder should not be used on the hands after gowning. This will prevent the relatively unsterile powder which has touched the hands from falling on the sterile gown. Canopies over sterile instrument tables prevent large numbers of bacteria from settling on the tables. The "splash basin" should contain an antiseptic solution such as Septisol or aqueous Zephiran 1:1000 rather than saline, because it has been shown that organisms are present in the saline solution by the end of an operative procedure. If PhisoHex or Septisol is used for the skin preparation, it should not be supplemented by the application of aqueous Zephiran, because Zephiran is inactivated by soap. The use of fine silk in all clean cases will reduce the incidence of hematoma and wound infections. The mixture of silk and catgut in a wound (the peritoneal cavity excepted) has been found to favor wound infections.

With regard to ward dressings, masks should be worn when changing dressings or inspecting all open wounds on the wards or in the clinics. Sterile gloves should be used when dressing open wounds, and instruments should be used to remove dressings from open wounds. When wound exudate is seen coming through dressings, the dressings should immediately be changed or reinforced. If wound exudates soil the bed linen, the linen should be changed immediately. After handling such dressings or linen, the nurses or attendants should wash their hands with great care.

Cultures should be taken as early as possible in every case of infection, so that the causative organisms can be isolated and their susceptibilities determined to the most effective antibiotics. A preliminary culture report should be available in 24 hours and the appropriate antibiotic treatment instituted at the earliest possible time. The bactericidal antibiotics, penicillin, bacitracin, neomycin, and polymyxin, should be used locally whenever they are indicated by these tests. Penicillin or bacitracin may also be used systemically if they are potent against

the causative organism and there are clinical signs of invasiveness. The bacteriostatic antibiotics are less effective in surgical infections than the bactericidal antibiotics, but should be used if they are the only ones potent against the organisms involved.

PROPHYLAXIS OF SURGICAL INFECTIONS

The appropriate antibiotics should also be used locally in all patients contaminated at the time of operation. This includes all operations in or contiguous to the body orifices where it is difficult to render the surfaces free of bacteria—the eye, the nose, the ear, and the external genitalia. This applies particularly to operations on the alimentary tract. The bacteria normally present at various levels from the mouth to the anus are legion, but they can be greatly reduced in number and often eliminated entirely by the preoperative oral administration of a combination of neomycin and bacitracin. Infection by these organisms is rendered less likely by the further use of these two antibiotics locally in the area of the operation at the time of contamination.

When the bacteriology is not known or until it is known, in order to cover the widest field, a combination of bacitracin and neomycin with their synergistic action is probably the most effective antibiotic mixture for local administration—the bacitracin covering the Gram-positive organisms and the neomycin the Gram-negative.

Cultures should be taken in all cases of accidental wounds and burns. The mixture of bacitracin and neomycin may be used locally immediately in the area of contamination to minimize the chance of infection developing. With burns, polymyxin should be added to the others, because it is the most potent antibiotic against most strains of the pseudomonas group of organisms so commonly participating in the infection associated with burns. The laboratory studies will indicate whether or not any other antibiotics are preferable, in which case a change should be made immediately on receipt of the laboratory report.

Someone on the surgical staff of every hospital should be assigned the duty of ascertaining the nature of wound healing in every surgical patient, both private and staff, and complications of wound healing should be reported each week at staff meeting. An attempt should be made to analyze the cause of the infection. Particular note should be made as to whether the appropriate antibiotics were used as soon as possible in the treatment of the infection. If such a plan is followed routinely, not only will more accurate records be kept, but a lower incidence of wound complications will result and the patient will receive the full benefit of our latest advances in the prevention and control of surgical infections.

SUMMARY

In spite of the availability of many new antibacterial agents, there is still a high incidence of infection in operative wounds—those which are clean, those

which are contaminated at the time of operation, and those which are contaminated before operation.

Such a situation has been found at the Jackson Memorial Hospital in Miami and it is assumed that the same conditions may exist in other hospitals.

Recommendations have been made for reducing the incidence of these infections and for bringing them under control, if they become established in spite of all precautions.

Continuous use of the bacteriology laboratory by the surgical staff is mandatory, for this makes possible the more discriminating use of the antibiotics and other antibacterial agents.

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PAROTID TUMORS AND THEIR SURGICAL MANAGEMENT *

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Various reports in the literature on tumors of the parotid gland indicate that the incidence of malignant lesions is between 25 and 50 per cent. The figure undoubtedly varies considerably from series to series because of the wide variation in the pathologic interpretation given to some groups of tumors of this gland. Also the high incidence of recurrence of parotid tumors after primary surgical treatment has raised the question of malignancy of many tumors, primarily of mixed tumors. Kirklin and associates, who reported the experience with this type of tumor at the Mayo Clinic between 1907 and 1944, classified 158 or 22 per cent of 717 parotid tumors as being malignant. In the 11 year period, 1945 through 1955, 779 parotid tumors have been seen at the clinic; 146 or 18.7 per cent of the 779 have been considered to be malignant.

Mixed tumors comprise approximately 70 per cent of all tumors of the parotid gland and are now generally considered to be benign tumors. However, the incidence of recurrence of this type of tumor after primary operation is reported to be approximately 35 per cent. In the series reported by Kirklin and associates the rate was 34 per cent, while in the series which I wish to report the rate of recurrence was 40.6 per cent (240 of 591). This high incidence of recurrence is the result almost entirely of inadequate primary surgical treatment. Fear of damage to the seventh cranial nerve and the patient's resulting facial paralysis have led many surgeons to be extremely conservative in the extensiveness of surgical removal of these tumors. This conservatism has led to failure in accomplishing that which the procedure was intended to do. If a surgeon knows the anatomy of the facial nerve and understands the technic of parotidectomy, a mixed tumor can be removed adequately primarily without danger of recurrence.

Usually untreated benign mixed tumors that have existed for many years or recurrent tumors may undergo carcinomatous transformation.^{6, 11, 22} This fact lends support to the advisability of complete removal of all mixed tumors of the parotid gland regardless of their benignancy.

When the physician considers these several facts, namely, the high incidence of malignancy of parotid tumors, the recurrence of benign mixed tumors, and the danger of carcinomatous transformation of benign tumors, he is justified in advising surgical removal of any parotid tumor known to be present. A physician is negligent in his duty if he suggests further observation of these tumors, advises the patient that "the tumor is not bothering you so don't bother it," or advises against surgical removal for fear of unintentional facial

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paralysis, a risk that is negligible if the operation is carried out by a competent surgeon.

Many patients are unwilling to accept recommendation that a parotid tumor be removed, since often the tumor has been present for 10 or 20 to 50 years, without a great deal of change in size or appearance and with complete absence of symptoms. When they are confronted with the possibility of cosmetic deformity as a result of surgical treatment, many are hesitant to accept treatment. It is the further obligation of the physician to explain the importance of surgical removal of parotid tumors to patients and that delay of adequate treatment increases jeopardy of the facial nerve.

Many classifications of parotid tumors have been advanced.^{7, 11, 13, 20} Most of them have been based primarily on clinicopathologic information and demonstrate the wide variation in tumors of the salivary gland. In the table an attempt has been made to classify parotid tumors in three groups. Treatment for tumors in each group is somewhat the same: benign tumors are removed by superficial or total conservative parotidectomy (nerve preserved); tumors of low grade malignancy are usually excised by total parotidectomy with probable sacrifice of all or part of the facial nerve; tumors of high grade malignancy are treated by total radical parotidectomy (nerve sacrificed) and probably neck dissection.

BENIGN TUMORS

Mixed Tumors. As mentioned previously, 70 to 75 per cent of all tumors of the parotid gland are mixed tumors. At the clinic, 591 of 779 parotid tumors seen during the period between 1945 and 1955, inclusive, were mixed tumors. These tumors can occur at any age but are seen most commonly in patients who are in the fourth and fifth decades of life. They are encountered in about equal number in the two sexes. Primarily they are rarely multiple or bilateral.¹⁴ Frequently recurrent mixed tumors are multiple, but their multiplicity is the result of seeding of the tumor in the operative site or of incomplete removal. The tumors have a pseudocapsule with pseudopods projecting away from it. In order to remove the tumors adequately and thus prevent recurrence it is necessary to resect these projections and a margin of normal tissue. Clinical reports show that mixed tumors usually have been present for many years and have demonstrated no growth or very slow growth. Function of the facial nerve is never impaired even if the tumor is large. Recurrent tumors may be associated with some paralysis or paresis as a result of previous operation. Pain is not typical of mixed tumors unless they are quite large and then there may be some discomfort associated with their presence. On examination, these tumors are usually hard or rubbery in consistency, are freely movable unless impinged in the bony bed of the parotid, and do not infiltrate adjacent tissues.

Microscopic study shows the mixed tumor to be composed of two groups of cells: One group comprises well-differentiated epithelial cells, with regular, round, dark nuclei, arranged in acini, cords and sheets or compressed into irregular masses. The other group of cells has the appearance of connective tissue

TABLE 1
Classification of parotid tumors

Benign tumors

1. Mixed tumors
2. Inflammatory diseases
 - a. Lymphadenopathy
 - Parinaud's syndrome
 - b. Chronic sialadenitis
 - c. Mikulicz's disease
3. Miscellaneous lesions
 - a. Warthin's tumor
 - b. Adenoma
 - c. Cyst
 - d. Hemangioma
 - e. Lymphangioma
 - f. Others

Tumors of moderate degree of malignancy

1. Cylindroma
2. Mucoepidermoid carcinoma
3. Acinic cell carcinoma
4. Adenocarcinoma—low grade

Tumors of high degree of malignancy

1. Adenocarcinoma—high grade
 2. Squamous cell epithelioma
 3. Undifferentiated and mixed type carcinoma
 4. Carcinomatous transformation of mixed tumor
 5. Lymphosarcoma
 6. Metastatic carcinoma
 - a. Melanoepithelioma
 - b. Others
-

cells, being either spindle or stellate, usually with abundant intercellular mucoid material, and occasionally resembling cartilage. As Kirklin and associates have pointed out, a small group of mixed tumors has been found in which the so-called second element cannot be identified. These lesions might be called "adenomas," with the epithelium resembling that of a mixed tumor. They are similar to mixed tumors and are not separated into an individual group.

Carcinomatous transformation of mixed tumors will be discussed under tumors of high degree of malignancy.

Enlarged Glands Simulating Parotid Tumors. Inflammatory tumors usually occur secondary to lymphadenopathy of the preauricular, subfacial or subparotid lymph nodes or as the result of chronic sialadenitis. The preauricular lymph node may become enlarged and present itself as a tumor 1 to 2 cm. in diameter directly in front of the tragus. It may feel similar to a mixed tumor but usually it is less hard and is slightly tender. In contrast to the mixed tumor, it is of recent origin. The cause may not be obvious in all cases. In Parinaud's syndrome, which is an oculoglandular variant of lymphoreticulosis or so-called cat-scratch disease, conjunctivitis with associated lymphadenopathy occurs in the parotid region.^{12, 21} External otitis is, on occasion, the primary source

of infection. Specific infections such as tuberculosis and actinomycosis are rarely the cause.

In chronic sialadenitis, the parotid gland may be firm as a result of fibrosis and intermittently enlarged. Acute episodes are associated with severe pain. The clinical history is usually all that is necessary to establish a diagnosis. Cysts may result from repeated attacks. Parotidectomy frequently is indicated for removal of inflammatory tumefactions and for relief of symptoms of acute attacks.

In Mikulicz's disease typical symptoms of bilateral swelling of all salivary glands and lacrimal glands are similar to symptoms of parotid tumors. Occasionally biopsy of a gland is necessary to establish a diagnosis.

Other Benign Tumors. Benign miscellaneous tumors of the parotid gland are numerous and include cysts, adenomas, lipomas, keratomas, and neuromas, in addition to Warthin's tumor, cavernous hemangiomas, and lymphangiomas.

Adenomas. Two types of adenomas occur: those probably arising from acinar cells of the parotid gland, and the oncoeytic adenoma, which is composed of rather large regular cells with abundant eosinophilic cytoplasm.

Warthin's Tumor. In recent years 2^{13} to 10^{16} per cent of benign tumors of the parotid gland have been diagnosed as Warthin's tumor²⁴ (papillary cystadenoma lymphomatosum), a tumor which has been recognized in only late years. In a review of parotid tumors seen at the clinic between 1905 and 1955, inclusive, Elliott found that 115 tumors occurring in 96 patients could be classified as Warthin's tumors. Of the 96 patients who had these tumors, 14.5 per cent had multiple tumors, while 11.5 per cent had bilateral tumors. The ratio of males to females was 8.6:1. Eighty-four per cent of the patients were in the fourth, fifth, and sixth decades of life. The primary symptom is a tumor situated in the parotid region near the lower pole of the gland. Average duration of the tumor is 2 to 3 years; most patients report slow growth of the tumor, if any, and fewer than 10 per cent had had pain attributable to the lesion. The tumor is firm but not hard, well encapsulated and not fixed.

Histologically the typical "two layered" pseudostratified columnar epithelium lines the cystic spaces. A basement membrane and also a lymphoid stroma are present in all cases. Elliott is of the opinion that the most logical theory concerning the cause of these tumors is that they develop from interlobular ducts of the parotid gland.

Cavernous Hemangiomas and Lymphangiomas. These two types of tumors, including cystic hygromas, are seen occasionally in children. They are usually first noticed shortly after birth and may become quite extensive and large. They are best removed surgically. At times tedious dissection is necessary to preserve the facial nerve.

PAROTID TUMORS OF MODERATE DEGREE OF MALIGNANCY

Tumors included in this group meet the criteria of malignant lesions because of local and distant spread, but they grow slowly and the patient may live for prolonged periods with knowledge that the disease is present. Nevertheless,

they are a threat to the life of the patient and most often require aggressive treatment.

Cylindromas. About 10 per cent of all parotid tumors are cylindromas. Quattlebaum and associates reviewed the experience at the clinic between 1928 and 1936, inclusive, and found that of 210 parotid tumors, 20 were cylindromas. Of the 779 parotid tumors seen at the clinic between 1945 and 1955, inclusive, 56 were cylindromas. These lesions are seen as frequently among men as among women and patients are in the same age groups as those who have mixed tumors. The patient may give a history of parotid tumor of several to 10 years' duration. About 50 per cent of patients will complain of mild to severe pain. Approximately 1 in 4 patients will show evidence of involvement of the facial nerve. On examination, more than 50 per cent of the lesions will be fixed to adjacent tissues. The tumor is hard and frequently feels invasive. The presence of pain, fixation, and paralysis of the facial nerve aids in differentiating this tumor from a mixed tumor.

Histologically the epithelial cells are dark staining and are in islands and strands, with central honeycombing in a hyaline stroma. This gives the typical "Swiss cheese" pattern. The spaces sometimes contain epithelial mucus. There is no capsule. Invasion along perineural spaces is typical.

Mucoepidermoid Tumors. Kirklin and associates encountered these tumors in 2.6 per cent of the cases studied; in the more recent series at the clinic they were encountered in 3.3 per cent (26 cases). Whether or not all of these tumors are malignant is questionable. Histologically it is difficult to determine whether they are benign or malignant and, because of this, all should be considered malignant. Clinically, however, their course is more favorable than that of other carcinomas. Some appear to be encapsulated while others do not.

Histologically the tumor consists of glandular epithelial cells, arranged in acini and associated with varying amounts of mucus, and of neoplastic cells having the characteristics of cells of squamous cell epithelioma.

Other infrequent tumors of moderate degree of malignancy are low grade adenocarcinoma and acinic cell carcinoma. Clinically they simulate other tumors in this group.

PAROTID TUMORS OF HIGH DEGREE OF MALIGNANCY

Tumors in this group comprise about 10 to 15 per cent of all tumors of the parotid gland (14.7 per cent in Kirklin's series and 12 per cent in patients with parotid tumors seen between 1945 and 1955). Tumors of high degree of malignancy occur about equally among both sexes and in any age group. Except for the tumors which have undergone carcinomatous transformation of a mixed tumor, they develop rapidly and death follows usually in a matter of a few months or a year or two. The typical history of the mixed tumor that is undergoing malignant change is that it has been present for many years without any appreciable change in size and then suddenly it has started to grow rather rapidly and has become progressively larger within a few weeks or months. Pain is a frequent complaint (30 per cent) of patients with tumor of a high degree

of malignancy, and in about 20 per cent of patients partial or complete paralysis of the facial nerve is evident.

Occasionally the presenting complaint associated with a parotid tumor is a nodule in the neck instead of a tumor in the parotid region, the nodule representing metastasis to regional cervical lymph nodes. Careful examination of the head and neck usually shows the primary lesion to be in the parotid gland. Kirklin and co-workers found cervical metastatic lesions in 31.5 per cent of patients with adenocarcinoma, 53.7 per cent of patients with squamous cell epithelioma, and 44.8 per cent of patients with undifferentiated carcinoma. Pulmonary metastatic lesions were found in 13 per cent of patients with adenocarcinoma and occasionally metastatic lesions were found in the spinal column and liver; distant metastatic lesions, however, were not found in patients with squamous cell epithelioma. Patients with undifferentiated carcinoma did not have pulmonary metastatic lesions but they did have metastatic lesions in the bone and distant cutaneous areas.

On physical examination tumors of high degree of malignancy are firm, infiltrative and fixed to adjacent tissues. It is difficult to delineate their borders and rarely are they encapsulated. However, in the case of metastatic lesions to the parotid, such as melanoepithelioma, lymph nodes may be circumscribed. If on examination several discrete nodules of recent origin are palpable in the parotid gland, melanoepithelioma or other metastatic carcinoma should be suspected.

On histologic examination the adenocarcinoma and squamous cell epithelioma are not unlike similar lesions occurring elsewhere in the body. The undifferentiated carcinoma is a highly neoplastic lesion that cannot be definitely classified. The carcinomatous transformation of mixed tumors has been described by others,^{11, 22} and currently my associates and I⁶ are reporting 29 such cases encountered at the clinic between 1907 and 1955. The malignant change is usually diffuse throughout the mixed tumor and is of a high degree of malignancy, either adenocarcinoma, squamous cell epithelioma, or a mixture of the two. Melanoepithelioma is occasionally thought to arise primarily in the parotid gland but usually it is secondary, the result of metastasis to the intraparotid or adjacent lymph nodes. Lymphosarcoma of the parotid gland is similar pathologically to lymphosarcoma seen in other parenchymatous structures and is usually lymphocytic in type.

SURGICAL ANATOMY

Davis and associates, in a recent paper, stated that their findings are in agreement with those of McWhorter, Bailey and others²³ in that the parotid gland is essentially a bilobed structure. Winsten and Ward, on the other hand, in an excellent study of both the embryologic and mature forms of the gland, stated that it is essentially a multilobular unilobar structure with grossly irregular outlines. My experience in performing approximately 250 superficial and total parotidectomies leads me to believe that, from the practical standpoint, the parotid gland is not composed of two lobes, but rather it is one glandular structure; and that the facial nerve does not divide and go around an isthmus but

actually lies within the substance of the gland. These findings are in agreement with those of Martin.¹⁵ The branches of the nerve are intimately enmeshed within the tissues of the gland and there is no natural line of cleavage between the gland and nerve. At the time of primary operation, however, a cleavage plane between parotid tissue and the nerve can be developed easily.

The surgical anatomy and technic of parotidectomy are discussed in separate communications.^{3, 5} Many authors^{17, 23} advocate identification of the multiple peripheral branches of the facial nerve as the initial step to locating and preserving the nerve in operations on the parotid gland. To do this is time-consuming and hazardous. Others^{1, 8} have advocated locating the posterior facial vein and the adjacent cervical branch of the facial nerve or the marginal mandibular branch of the facial nerve, and then following one of these branches of the nerve posteriorly to the main trunk of the nerve. This, too, is fraught with danger because of variations in the anatomy of the nerve and because of the difficulty in identifying a small radicle of the nerve.

The main trunk of the nerve as it leaves the stylomastoid foramen and enters the gland is a large structure in comparison to its branches and can be easily identified by approaching it directly. First, an adequate inverted T or Y incision is made in front of and below the ear and the skin flaps are elevated to expose completely the parotid gland. The posterior aspect of the gland is then retracted upward and anteriorly. The main trunk of the nerve is located medial and deep to the mastoid process. After it has been identified, the two divisions and the multiple branches can be readily exposed as the superficial portion of the parotid gland is lifted from the nerve by blunt dissection. This procedure should be considered a superficial parotidectomy and not a superficial lobectomy, since there are no true lobes to the parotid gland.

The deep portion of the parotid gland can be removed, if indicated, usually without difficulty from between the two divisions of the nerve or from beneath the lower division. When the nerve is preserved, the surgical procedure should be considered a total conservative parotidectomy in contrast to a total radical parotidectomy when the nerve is intentionally sacrificed.

The anatomy and technic of a radical neck dissection, which occasionally is carried out en bloc with parotidectomy, have been reported previously.⁴

SURGICAL TREATMENT

For benign tumors of the parotid gland, the minimal surgical procedure should be superficial parotidectomy unless the lesion is very small and situated on the surface of the gland or in the lower pole. By removing the superficial part of the parotid gland in excision of a tumor, an adequate margin of normal tissue is obtained about the lesion and the nerve is exposed, which protects it fully. After superficial parotidectomy is accomplished, if the tumor is found to be on the deep surface of the specimen or situated in the deep part of the gland, the procedure should be completed as a conservative total parotidectomy. The use of this surgical approach for excision of mixed tumors should reduce the recurrence rate for these lesions to a minimum.

Preferably biopsy of a tumor should not be carried out, for this contaminates

the surgical field at the time of the definitive operative procedure. If fresh frozen section is not available for diagnosis, then preliminary needle biopsy might be considered. The needle tract should then be excised at the time parotidectomy is performed.

If in the course of accomplishing superficial parotidectomy the tumor is encountered and is thought to be malignant, biopsy should be carried out immediately. If the tumor proves to be malignant, the surgical procedure can be altered as indicated.

For lesions that are of a moderate degree of malignancy, total radical parotidectomy usually should be done. However, in selected cases the nerve or a portion of it might be preserved when the lesion is localized to one part of the gland.

If the tumor is of a high degree of malignancy, radical total parotidectomy should be accomplished in all cases.

If cervical nodal metastatic lesions are present clinically or found at operation, a radical neck dissection should be carried out in continuity with the parotidectomy, provided there is no evidence of distant metastasis. Possibly radical neck dissection should be carried out in the presence of all malignant lesions. However, because of the frequency of distant metastatic lesions when the cervical nodes are metastatically involved, I am hesitant to recommend it as a routine procedure.

When the facial nerve has been sacrificed, consideration should be given to implantation of a nerve graft between the stump of the nerve and the peripheral branches brought together in groups. This has been described previously,³ and the results thus far have been gratifying. In cases in which grafts have been inserted, gross function has returned in 12 to 18 months. If the nerve graft fails, then nerve transplant or cosmetic procedures can be considered.

SUMMARY

With increased appreciation of the wide variety of tumors occurring in the parotid gland and the application of adequate surgical therapy for their removal, the high recurrence rates of benign mixed tumors and of malignant tumors should be greatly reduced. For benign tumors, the minimal surgical procedure should be superficial parotidectomy if the lesion is in the superficial part of the gland or a conservative total parotidectomy if it is situated in the deep part of the gland. For malignant lesions, radical total parotidectomy and possibly radical neck dissection should be done.

Section of Surgery

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THE TREATMENT OF UPPER GASTROINTESTINAL HEMORRHAGE

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The problems associated with upper gastrointestinal hemorrhage continue to challenge physician and surgeon alike. Methods of diagnosis and treatment in various institutions continue in a constant state of evolution in directions that are not necessarily parallel, since patient material and available therapy differ significantly. Since it follows that any individual can present authoritatively only the results of his own experience, it will be the purpose of this paper to present a brief summary of the treatment of this disease as it now is carried out in the Massachusetts General Hospital. For the purposes of this discussion, data derived from 335 patients observed with hemorrhage from the upper gastrointestinal tract during the years 1954 and 1955 will be analyzed. Those patients with a history of bleeding are omitted and only those who manifest bleeding at some time during the hospital admission are included in this study.

For many years it has been customary to describe hemorrhage as minor, moderate or severe. Patients with minor hemorrhage are defined as those who have an episode of melena, or less commonly, hematemesis, that stops promptly without any significant effect upon the red blood cell mass. Those with major hemorrhage, at the other end of the scale, have had blood loss sufficient to drop the hemoglobin below 7 grams or to require 5 or more transfusions during the hospital admission. Those patients with hemorrhage of moderate severity comprise all not included in other groups.

It is apparent that hospital deaths of patients who have manifested minor bleeding at some time during the admission are not due to hemorrhage. This also is essentially true for patients who have had moderately severe hemorrhage although in some instances a relatively small drop in hemoglobin may initiate a fatal complication; for example, a coronary thrombosis may follow immediately after a hemorrhage of only moderate severity. In contrast, all patients who have had a severe hemorrhage may be considered to have died directly because of blood loss. This does not mean, however, that every patient with massive hemorrhage could be saved if appropriate measures were taken, since many will be nonsalvageable because of such diseases as metastatic cancer or uremia. This irreducible minimum is reflected in a continuing high mortality of patients with massive hemorrhage treated medically.

In the selection of the choice of treatment for hemorrhage, we have been guided by the following principles.

1. Hemorrhage that is minor or moderately severe is not life-endangering, and is treated primarily by medical means. Repetitive episodes, if the causative

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lesion is proved to be ulcer, will raise the question of surgery, and in most cases it is done after two separate episodes of bleeding. If the source of the hemorrhage is shown to be tumor, operation is indicated regardless of the amount of bleeding.

2. A single massive hemorrhage, on the other hand, is an indication for surgery when the hemorrhage is known to originate from a gastric, duodenal, or anastomotic ulcer.

3. Operations performed during the acute phase of hemorrhage, as emergencies, carry a higher mortality than those carried out in the interval phase.

4. If a severe hemorrhage from any source other than ulcer is not controlled by more conservative measures, operation is indicated, provided that a blood dyscrasia is not present, and the patient is considered to have no accompanying disease that soon would be fatal even if bleeding were controlled.

The selection of proper therapy therefore is dependent upon two keystones—accurate diagnosis and early recognition of the type of hemorrhage. While both must be considered simultaneously in practice, it is expedient in this discussion to discuss them separately.

Diagnosis: Diagnosis of the source of the hemorrhage is directed particularly to the elimination of those few patients who have some other systemic disease, and to the segregation of the large group of patients who are bleeding from esophageal varices. This is very important since ordinarily the first group will not be subjected to operation, those with varices will have a transthoracic operation, and all other patients will have surgery carried out, if it is necessary, through an abdominal incision.

In most instances a complete history and physical examination will give an accurate diagnosis. The stigmata of portal hypertension, large liver or spleen, ascites, slight jaundice, spiders or gynecomastia may give the clue. Particular interest is attached to several other diagnostic methods which include the emergency X-ray examination, emergency esophagoscopy and gastroscopy, and various studies of the blood chemistry.

The emergency X-ray has been established as an important diagnostic aid. Carried out by the no-palpation technic at a time when the patient can be transported safely to the X-ray department, it should be no more dangerous to the patient than swallowing a glass of milk. Positive information may be expected in about 75 per cent of the patients who are bleeding from varices or ulcer. In particular, a chronic gastric ulcer is very rarely overlooked at this examination. Negative findings must be interpreted with caution, and, if continued bleeding does not force immediate operation, a repeat examination is necessary a few days later.

Emergency esophagoscopy or gastroscopy is, on the other hand, a much more difficult examination. In the presence of active bleeding, the identification of varices by esophagoscopy may be impossible, and the hazard of the procedure in unanesthetized patients, who are not always cooperative, has led us to use it infrequently. Undoubtedly gastroscopic examination within a few days of the hemorrhage will demonstrate bleeding gastritis in some instances in which the source of the hemorrhage cannot be found in any other way. The importance

of a vigorous diagnostic approach by these methods has been shown by Palmer and Scott, from New Haven. In 163 cases they carried out early esophagoscopy in 105 cases, gastroscopy in 136 and fluoroscopy in 159. The source of bleeding was identified in 83 per cent of the patients.

Of the studies of the blood chemistry, the bromsulfathalein retention test has had the widest application. When retention is over 15 per cent at the end of 30 minutes, diminution of hepatic function due to cirrhosis is almost sure to be present. On the other hand, oligemic shock itself, due to blood loss from an ulcer, does not impair hepatic function. Smythe et al recently reported the cases of 20 patients with bleeding, who had a high B S P retention, and of this group only 2 did not have liver impairment by severe alcoholism or cirrhosis.

McDermott has recently developed in our hospital a quantitative test based upon the blood ammonia level that aids in the identification of patients with hepatic dysfunction. Following a hemorrhage, bacteria in the intestine split the protein, producing ammonia. In the presence of a normal liver, the ammonia is quickly converted into urea and the blood ammonia level remains normal; if cirrhosis is present urea formation is slowed and the blood ammonia level will rise. This test theoretically could fail if the blood loss were entirely due to hematemesis or if the intestinal tract had been sterilized by antibiotics prior to the hemorrhage. However, in slightly over 100 tests it has proved to be an accurate method.

Neither the B S P retention or ammonia retention tests can be expected to be of value when the patient with cirrhosis is bleeding from an ulcer. Fortunately in our patients who had cases massive hemorrhage and were subjected to surgery, only 3 out of 56 with portal hypertension had both an ulcer and esophageal varices. Of these one had a healed duodenal ulcer, one had an active duodenal ulcer but died of bleeding esophageal varices, while the third had varices but died of a bleeding gastric ulcer.

By these various tests a final diagnosis of the source of the bleeding was established in 279 out of our 335 patients, or 83 per cent of the total (table 1).

Determination of type of hemorrhage: While the diagnosis is becoming clarified by the methods discussed here, the patient by his clinical course establishes the category of bleeding into which he finally will be classified. It is dangerous to assume that what is apparently a minor hemorrhage at the time of hospital entry will remain so. The utmost vigilance is necessary, particularly during the first 5 days after the overt bleeding. During this period the patient is watched on the surgical service. The indications for or against surgery must be weighed frequently.

At this time the surgeon bases his decision upon the probable diagnosis and the amount of bleeding that has been demonstrated. For the sake of convenience, the common clinical patterns that are encountered will be discussed separately.

(a) *Esophageal varices:* Bleeding from varices is likely to be massive (table 2.) In the few patients where it is not severe, preparation should be made for a shunt, to be done as soon as proper liver function can be assured.

When bleeding is massive, the surgeon is faced with several courses of action,

TABLE I
Upper gastro-intestinal hemorrhage
Massachusetts General Hospital 1954-1955

	Mild		Moderate		Severe		All Cases		Mortality %
	Total	died	Total	died	Total	died	Total	deaths	
Esophageal varices.....	8	1	9	0	56	27	73	28	38.4
Hiatus hernia.....	4	0	0	0	1	0	5	0	0
Gastritis.....	9	0	7	0	6	1	22	1	4.5
Gastric ulcer.....	3	0	2	0	29	7	34	7	20.6
Duodenal ulcer.....	32	1	23	1	69	8	124	10	8.1
Anastomotic ulcer.....	0	0	0	0	4	0	4	0	0
Cause undetermined.....	33	0	8	0	15	3	56	3	53
Tumor.....	1	0	1	0	9	4	11	4	36.3
Other.....	4	2	0	0	2	0	6	2	33.3
Total.....	94	4	50	1	191	50	335	55	16.4

Deaths due to hemorrhage = 46 = 13.7%.

TABLE 2
Hemorrhage from esophageal varices
Massachusetts General Hospital 1954-1955

Type of Hemorrhage	Medical Treatment		Surgical Treatment		All Cases Total	
	Total	Deaths	Total	Deaths	Total	Deaths
Mild.....	8	1*	0	0	8	1
Moderate.....	4	0	5	0	9	0
Massive.....	22	16	34	11	56	27
Total.....	34	17	39	11	73	28

* Death not due to hemorrhage.

none of which is certain to be effective. The surest method of control, we believe, is a transthoracic esophagotomy, with ligation of the bleeding varices. This extensive operative procedure has two principal disadvantages—the surgeon is unable to explore the peritoneal cavity through this approach, and the mortality of the operation is high. For this reason there should be at least one trial of the Sengstaken balloon (or the Linton modification.) In most instances this will control the bleeding. Meanwhile, if blood continues to drain from the stomach while the balloon is inflated, the surgeon is provided with an indication that the bleeding may be from the stomach or duodenum, rather than from the esophagus. This means of differentiation however has not been entirely accurate, and, in some instances, varices have continued to bleed despite inflation of the balloon.

If bleeding ceases and then recurs a few days later, and the patient apparently has a reasonably good liver reserve, ligation of varices is carried out. If the patient is in serious liver failure, a second trial of the balloon is probably wisest.

If the ligation of varices is well tolerated and the patient survives, a shunt should be carried out within the ensuing 6 weeks since a longer interval will invite recurrent hemorrhage.

Because of the disadvantages of the transthoracic ligation of varices mentioned above, other operative methods should be considered. Stuart Welch has advocated ligation of the varices through an abdominal approach, a procedure that has manifest advantages from the point of view of diagnosis, but is hampered considerably by the presence of a cirrhotic liver. Tanner has described a transection of the stomach and all vessels of the lesser curvature, re-establishing gastric continuity by immediately resuturing the divided organ. This is somewhat simpler than a proximal gastrectomy which will accomplish the same purpose. While we have had some experience with these alternative operations, we still believe that the transthoracic approach to ligation of the varices is the best method. The mortality, although high, is ascribable chiefly to the underlying disease, and it is hard to see how it could be reduced by any simpler procedure.

(b) *Gastric, duodenal or anastomotic ulcer.* With these lesions there are several factors that lead to the consideration of emergency, rather than delayed surgery. The first is the location of the lesion. From data presented here, and from previous studies, it appears that minor episodes of bleeding are distinctly less common, and the mortality of massive hemorrhage greater with gastric or anastomotic ulcer than they are with duodenal ulcer. The surgeon, therefore, must be particularly alert when he is dealing with gastric or anastomotic ulcer.

It has been stated above that a single major hemorrhage is sufficient indication for operation in a patient with ulcer. It has been our policy in the past, if the hemorrhage stopped spontaneously, to perform a gastric resection within a few days of the hemorrhage if it originated from a gastric or anastomotic ulcer, and about 6 weeks later if the source was a duodenal ulcer. Within the past few years a more rapid approach has become customary with duodenal ulcer as well. The great advantage in operating later on a patient with bleeding duodenal ulcer is that an exclusion procedure can be done with safety at that time, while any exclusion operations done at the time of the acute hemorrhage are hazardous.

In addition to the anatomic site of the ulcer, the age of the patient is of significance. Older patients tolerate any physical insults less well than the young. If to a hemorrhage is added a protracted period of starvation, intravenous feeding and immobilization, the patient is likely to succumb from an accumulation of minor complications. An expeditious operation often will reduce the length of convalescence considerably. With patients over 70 years of age, an emergency operation seems wisest, unless the hemorrhage clearly stops soon after the patient arrives, allowing rapid replacement of the red blood cell mass and resumption of oral intake. Closely related to the age of the patient is the age of the ulcer. Old, chronic ulcers that have been known to exist for many years have a fibrotic base, so spontaneous cessation of bleeding becomes less likely. These chronic long-standing ulcers obviously are much more common in old than in young patients.

A third group of patients with ulcer, for whom emergency surgery is necessary, includes those who are bleeding so rapidly that control is not possible without operation. Fortunately these patients are not numerous, but do include those with erosions of the left gastric or gastroduodenal arteries. If 5 or more transfusions are required within 24 hours to effect stabilization of pulse and blood pressure at a satisfactory level, immediate operation is essential.

A fourth group includes those patients who have demonstrated that they have had a massive hemorrhage, but, having apparently stopped, resume bleeding. Such recurrent bleeding is not always easy to pick up. A sudden drop in blood pressure, sudden elevation of pulse, faintness, weakness, sweating, or bright red blood appearing from an inlying Levin tube are indications and mean that surgery should be carried out as expeditiously as possible. Particularly in the older age group observation must be very careful, particularly during the night.

Finally, if there is a limited supply of compatible blood, early surgery should be considered. Usually 3 or 4 transfusions of 500 cc. are required, during one of these operations, and, if little more than this amount is available, it had best be used in an immediate all-out attack rather than frittering the blood away before operation.

These factors then are the ones of importance in the selection of surgery as the method of treatment of massive hemorrhage from a proved ulcer of stomach, duodenum or jejunum— (1) a gastric or anastomotic ulcer, (2) an old patient, or an ulcer of long-standing, (3) continued severe bleeding, (4) recurrent bleeding, and (5) an inadequate supply of compatible blood.

Gastritis: Emergency operation is required only rarely as a means of treatment of gastritis. There are several reasons for this conclusion. Most bleeding from gastritis tends to be mild or moderate in degree, so that spontaneous cessation is the rule. An initiating cause such as alcohol or aspirin is often obvious, so that elimination of the irritant should influence the gastritis favorably. Furthermore, unless the surgeon finds only a localized area of gastritis, or performs a total gastrectomy, recurrent bleeding from the gastric remnant can occur and be a very serious problem. Though it has not been necessary in our hospital, the writer knows of instances in which a total gastrectomy was finally required to control hemorrhage from gastritis.

Tumors: Whether bleeding is mild, moderate or severe, demonstration of a tumor in the stomach or duodenum is a positive indication for surgery. In other instances irremovable tumors of the pancreas, biliary tree, or liver may produce exsanguinating hemorrhage.

Bleeding from an undetermined cause: These are intriguing patients that provide most difficult diagnostic and therapeutic problems. In the clinical care of these patients two questions are uppermost. They are (1) what actually is the source of the bleeding and (2) if surgery is required in the absence of a positive diagnosis, how is it conducted and what results may be expected? These will be considered in order.

1. What is the source of the hemorrhage? Hemorrhage from an indeterminate

source has accounted for nearly one-third of our cases of minor hemorrhage, and for nearly 8 per cent of the major. In 3 instances patients have died of hemorrhage from an indeterminate source. Even an autopsy may not be revealing since rapid postmortem degeneration may erase all trace of the underlying lesion.

Any attempt to procure a final diagnosis in all of these patients is bound to result in failure. Dr. J. E. Tetirick, one of our residents, recently conducted such a survey. He followed 86 patients in whom a source of bleeding was not established after several days or more of thorough study. In 18 patients, (21 per cent) the cause finally was discovered. It proved to be gastritis in 11 cases, duodenal ulcer in 2, and multiple telangiectasis, neurofibroma of duodenum, gastric ulcer, gastric cancer, and traumatic erosion of the gastric mucosa by a wood splinter in 1 case each. From those figures it may be inferred that bleeding in these cases of indeterminate source is most likely to arise from gastritis.

The ultimate means by which the diagnosis was made in these 18 cases is also of interest. Exploratory laparotomy revealed the source of bleeding in 6 patients, and in 4 others the lesion was discovered only after a blind gastrectomy. In 3 other patients gastroscopy was performed soon after a later episode of bleeding and active bleeding from gastritis was demonstrated.

These studies, as well as those of others, indicate that if the number of patients with bleeding from an indeterminate cause is to be reduced, an aggressive attempt should be made early in the course of the hemorrhage to establish the source.

2. What type of surgery is indicated for hemorrhage from an indeterminate source? In these instances the surgeon cannot make an accurate preoperative diagnosis of the source of the bleeding. Since most of these patients eventually turn out to have bleeding gastritis a somewhat more conservative course is indicated than if the patient had an ulcer. However, two particular groups of patients will demand operation. In the first, continued massive bleeding, requiring over 5 transfusions in 24 hours will force the surgeon's hand. In the others, continued blood loss in the stool will lead to exploration. In the latter case a small bowel tumor, or undiscovered gastric tumor is a likely diagnosis.

When surgery is necessary for bleeding, and the cause is not known, the incision must be adequate to explore the whole abdominal cavity. Careful palpation of stomach and duodenum first are carried out since an unsuspected ulcer may be found. The small bowel then is inspected meticulously. If no lesion is apparent by this time the surgeon has the choice of proceeding with a "blind" gastrectomy, or of attempting to identify the source by a long gastrotomy incision that will have to be extended across the pyloric ring if the gastric mucosa is negative. Both methods have their merits and disadvantages. A gastrotomy often will show the bleeding point, but is a somewhat dirty procedure and may be confusing because of blood seeping from the cut margins of the stomach. If a blind gastrectomy is done, the duodenal stump must be inspected with great care before closure to be sure that a postbulbar ulcer is not overlooked. Likewise, the fundus of the stomach must be laid open and observed before closure. Meanwhile the resected stomach is examined, since superficial gastric erosions often will be found.

If gastrotomy has been done and no lesion has been demonstrated, then we believe a subtotal gastrectomy should be carried out. The pathologist usually finds gastritis on microscopic diagnosis.

If no definite cause has been found for the bleeding at the time of operation, and subtotal gastrectomy has been done, the surgeon usually is unhappy because he believes that he has overlooked a lesion in the fundus that may bleed at a later date. This has happened in several instances in our hospital where there was extensive gastritis present. However, in only one patient has this hemorrhage been fatal; in this instance a cirroid aneurysm was left in the fundus after a subtotal gastrectomy. This patient died after a secondary total gastrectomy was carried out as an emergency procedure to stop the bleeding. It must be granted that subtotal gastrectomy will carry a definite mortality, but, in our opinion, the advantages of the procedure usually outweigh this feature. Follow-up studies from the Mayo Clinic give evidence proving the importance of gastrectomy in these cases. Gray, Shands and Thuringer found 48 such patients. Twenty-eight had had surgical exploration only, and 63 per cent had recurrent hemorrhage within 5 years. Twenty patients had partial gastrectomy and only 11.7 per cent had recurrent hemorrhage. Of these 20 patients, 8 had a definite lesion found within the resected stomach, while the others had gastritis.

Data derived from the Massachusetts General Hospital cases observed during 1954-1955 will now be considered, to illustrate the results of these policies.

Incidence and mortality of bleeding: (Table 1). Three hundred and thirty-five patients with bleeding were observed during this period. There were 55 deaths, an over-all mortality of 16.4 per cent. Nine deaths could not be ascribed to the bleeding; on the otherhand, all patients who died with massive hemorrhage were counted as dead or hemorrhage, although many with cirrhosis were in the terminal stage of liver failure.

The bleeding was mild in 94 cases, (28 per cent) moderately severe in 50 cases, (15 per cent) and massive in 191 (57 per cent). Although some patients died in the first two groups, the mortality from hemorrhage was limited to those with massive bleeding; here the over-all mortality was 26 per cent.

Hemorrhage from specific lesions: (A) Esophageal varices:

Esophageal varices were found in 22 per cent of all bleeding patients, but in 29 per cent of those with massive hemorrhage. This indicates that massive hemorrhage is the predominant type of bleeding from cirrhosis. The over-all mortality was 38.4 per cent, and of massive hemorrhage 48 per cent. These figures again emphasize the extreme hazard of this type of hemorrhage. Following massive hemorrhage, surgical treatment was carried out in 34 cases. Of the 11 deaths, 6 occurred after 15 emergency operations for control of hemorrhage and 5 after shunts had been performed in an interval stage.

(B) *Gastric ulcer:* (Table 3). Thirty-four patients bled from a gastric ulcer. Here again the bleeding tended to be massive, 29 of the patients demonstrating this type of bleeding. Four deaths occurred in patients treated medically, however, 1 of them was in the hospital with terminal heart disease, 1 had bacterial

TABLE 3
Hemorrhage from gastric ulcer
Massachusetts General Hospital, 1954-1955

Type of Hemorrhage	Medical Treatment		Surgical Treatment		All Cases Total	
	Total	Deaths	Total	Deaths	Total	Deaths
Mild	3	0	0	0	3	0
Moderate.....	2	0	0	0	2	0
Massive	5	4*	24	3	29	7
Total	10	4*	24	3	34	7

Deaths due to hemorrhage = 11.8%

* 3 deaths were not due to hemorrhage.

TABLE 4
Hemorrhage from duodenal ulcer
Massachusetts General Hospital 1954-1955

Type of Hemorrhage	Medical Treatment		Surgical Treatment		All Cases	
	Total	Deaths	Total	Deaths	Total	Deaths
Mild	32	1*	0	0	32	1
Moderate.....	18	1*	5	0	23	1
Massive	22	3*	47	5	69	8
Total	72	5*	52	5	124	10

Deaths due to hemorrhage = 4%.

* Deaths not due to hemorrhage.

endocarditis with cerebral infarcts and 1 had metastatic reticulum cell sarcoma. The only patient not operated upon, and who possibly could have been salvaged, also had advanced cirrhosis and ascites.

Physicians on the medical service as well as the surgeons therefore have been extremely vigilant, and have not denied any patients the choice of cure by surgery. The mortality of potentially salvageable cases is now ascribable to the surgical service and will be discussed below.

(C) *Duodenal ulcer:* (Table 4). Duodenal ulcer is the most common single cause of hemorrhage accounting for 37 per cent of all cases, and for 36 per cent of all cases of massive hemorrhage. Bleeding of mild or moderate degree was encountered much more commonly than with gastric ulcer. Five deaths occurred in patients treated medically, but none could be ascribed to the hemorrhage; of the 3 patients with massive bleeding, 1 was an infant with pancreatic fibrosis, 1 had a brain tumor, and 1 was in the terminal phase of uremia.

Here again every patient who could have been salvaged by surgery has been operated upon.

(D) *Other causes of bleeding:* Since other causes of bleeding are numerically much less frequent they will not be considered in detail.

Surgical considerations: The common surgical procedures for the emergency control of hemorrhage carried out in this series have been ligation for bleeding esophageal varices, and subtotal gastrectomy for bleeding from other sources. A few patients have had other operations including resection of a segment of small intestine, total gastrectomy, or gastrotomy alone. The over-all mortality of emergency ligation of varices was 40 per cent, and of emergency subtotal gastrectomy, 15 per cent.

Methods of treatment of hemorrhage from gastritis, duodenal and jejunal ulcer are particularly important since it is here that the indications for, and methods of operation have been studied for the longest period. Deaths due to hemorrhage were 4 per cent for duodenal ulcer, and 11.8 per cent for gastric ulcer. The over-all death rate of these patients with hemorrhage was higher for reasons discussed above, (8.1 per cent for duodenal ulcer, and 20 per cent for gastric ulcer.)

TABLE 5
Mortality emergency operations
Massachusetts General Hospital 1954-1955

	Cases	Deaths	Mortality %
Ligation esophageal varices	15	6	40
Subtotal gastrectomy	60	9	15
Other operations	11	4	36
Total	86	19	22

TABLE 6
Causes of deaths after emergency surgery

Esophageal Varices—6

Splenorenal shunt—bled 3 weeks later—had ligation varices—died pancreatic abscess.

Ligation varices only—endocarditis and empyema, esophageal fistula, continued bleeding and liver failure, lower nephron nephrosis, superior mesenteric vein thrombosis, 1 each.

Subtotal Gastrectomy—9 (After operations for ulcer 8, gastritis 1.)

Technical 6 (Perforation gallbladder, mesenteric thrombosis, perforated gastric suture line, rupture diaphragm, subdiaphragmatic abscess, peritonitis, 1 each.)

Other 3 (Severe atelectasis, cerebral thrombosis, multiple myeloma, 1 each.)

Other Operations 4 Plication duodenal ulcer & P G E—died of continued hemorrhage, 1

Gastrotomy—died of cardiac arrest on operating table,
Intestinal resection for tumor—died of mesenteric thrombosis,
Ligation right hepatic artery for bleeding hepatoma—died of hepatic failure,

Of the patients with massive hemorrhage from ulcer treated surgically there were 75 cases with 8 deaths (mortality = 10.6 per cent.) All patients under 60 years of age survived, and there were only 2 deaths below the age of 70. The mean age of the patients treated surgically was 55.

While these figures indicate that progress has been made, it still must be recognized that deaths will occur after surgical operations in patients who potentially should be saved. This is particularly true of the patients with ulcer. Of the 8 deaths in this series autopsy showed that most were due to technical errors. Methods to avoid these errors have been discussed in a previous publication and will not be repeated here. Suffice it to say that technical proficiency must be developed sufficiently to meet the challenge that has been given to the surgeon.

SUMMARY

The general principles of the management of patients with gastrointestinal hemorrhage have been discussed as they have been applied in the Massachusetts General Hospital in the years 1954-1955. During this period all potentially salvageable patients with life-endangering hemorrhage have been treated by operation. A reasonable mortality has been attained except in those patients who have advanced liver disease, or who bleed after the age of 70 years.

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SOME ANATOMIC OBSERVATIONS IN THE INGUINAL REGION

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The variations in the aponeurosis of the external oblique are very few. In my opinion those that are found to be present do not seem to affect the repair of the region if the external oblique aponeurosis is strong and not too thinned. Four hundred and eighty-three hernia repair procedures have been performed on 436 patients. My use of the term "procedure" means the repair of an indirect hernia or a direct hernia; a combined direct-indirect or saddle hernia; a combined direct-femoral hernia or a femoral hernia. Tables I, II, and III give a complete analysis of hernias as they occurred in this series. A review of the anatomy of the inguinal region as found in the repair of a consecutive series of 483 hernias has revealed a number of variances in the inguinal region. These variations have been described by a number of distinguished authors. Some reports have been based upon anatomic dissection of the cadaver, and some have been based upon clinical anatomy as found in the repair of hernias in the inguinal region of patients. Dissections on patients cannot be done simply to obtain helpful information. However, the anatomy as portrayed in the living individual when compared with the dissections on the cadaver reveals a number of differences.

Anson and McVay¹ found that in 97 per cent of patients the lower border of the internal oblique muscle reached the spermatic cord, while it stopped at some distance in the remaining 3 per cent. They also found that the lower border of the transversalis abdominis muscle reaches the cord in only 3 per cent of patients and stops at a distance in all of the others.

This difference results in variations in Hesselbach's triangular area formed by the inguinal ligament below, the lower border of the internal oblique and the transversalis abdominis muscle above, and the lateral border of the rectus muscle medially. The longer the medial border of the triangle, the larger will be the weak portion of the posterior wall of the inguinal canal. Therefore a relationship between the size of this triangle and the direct inguinal hernia has been established.

Like Anson and McVay, Chandler² also describes marked variations in the transversalis fascia, the transversalis abdominis muscle, the internal oblique muscle, and the conjoined tendon—or aponeurosis.

Dougdale and Burton³ review the history of the triangulation of the inguinal region from that reviewed by Hesselbach in 1906 forward. They describe the region as a pyramidal space, consisting of a superior or extrapelvic triangle and an inferior or intrapelvic triangle. These triangles are specifically divided into five smaller anatomic triangular units.

Numerous authors, since the turn of the century, noticed that in a high per-

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TABLE I
Total analysis of 483 procedures done on 436 patients

	Unilateral						Bilateral							
	Indirect		Direct		Combined		Indirect		Direct		Combined			
	R*	L†	R	L	R	L	R	L	R	L	R	L		
Total sliding femoral	140 (5)	84	28	12	20	13	38	39	17	19 (1)	36	23 (1)		
% of each.....	28.0	17.4	5.7	2.4	4.1	2.7	7.8	8.0	3.5	3.0	7.4	4.7		
	Recurrent Unilateral						Recurrent Bilateral						Femoral	
	Indirect		Direct		Combined		Indirect		Direct		Combined			
	R	L	R	L	R	L	R	L	R	L	R	L	R	L
Total sliding femoral	4	1	0	1	0	1	0	0	2	3	0	0	0	2
% of each.....	.8	.2	—	.2	—	.2	—	—	.4	.6	—	—	—	.4

* RIGHT, † LEFT

TABLE II
Analysis of 483 procedures done on 436 patients with respect to types and locations only

	Indirect		Direct		Combined		Femoral	
	R*	L†	R	L	R	L	R	L
Total.....	182	124	47	35	56	37	—	2
% of each.....	37.6	25.6	0.7	7.2	11.5	7.6	—	.4

* RIGHT, † LEFT

TABLE III
Analysis of 483 procedures done on 436 patients with respect to types only

	Indirect	Direct	Combined	Femora.
Total.....	306	82	93	2
% of each.....	63.3	16.9	19.2	.4

centage of dissections there was a marked variation in the insertion of the internal oblique and transversalis abdominis muscles, probably due to a defect of the formation of the lower fibers of the internal oblique and transversalis abdominis muscles.

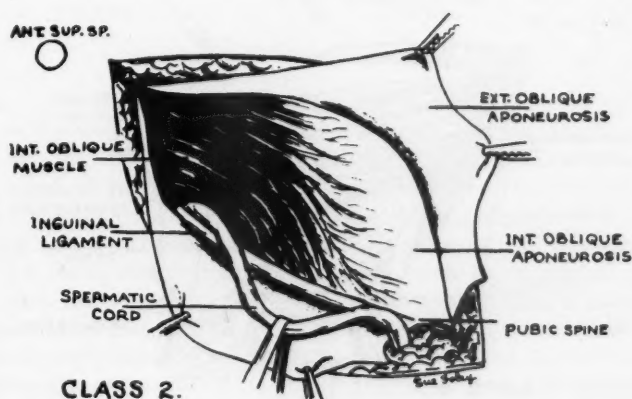
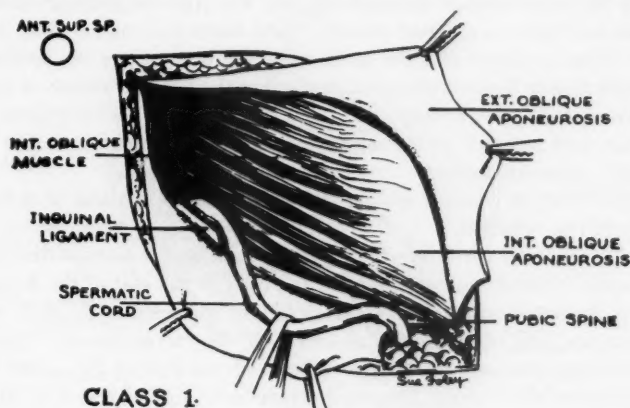
Zimmerman⁵ believes that the cause of a direct hernia is a congenital weakness of the inguinal wall due to the absence of the lowermost fibers of the internal oblique muscle, thus leaving a triangular area which is devoid of muscular support. As a result, the transversalis fascia, which is unsupported in this area, is

unable to withstand the abdominal pressure, and therefore, ruptures. Hence, the pathologic condition is a defect in the transversalis fascia accompanied by an absence of overlying muscle or aponeurotic support.

For practical purposes these variances are divided into four classes.

Class I reveals that the fibers of the internal oblique muscles, from their origin, arch over and continue down as a pyramid of thick muscle fibers. This pyramid of muscle fibers continues over the lower end of the rectus muscle and inserts itself directly into the fascia and the covering of the pubic spine and the upper portion of the symphysis pubis itself. They, then, insert laterally along the ilio-pectineal line posterior to the cord. Above this pyramid, the muscle fibers of the internal oblique transform or insert themselves into an aponeurosis which forms the posterior half of the anterior sheath of the rectus muscle.

In this class, I make no attempt to find or isolate the transversalis abdominis



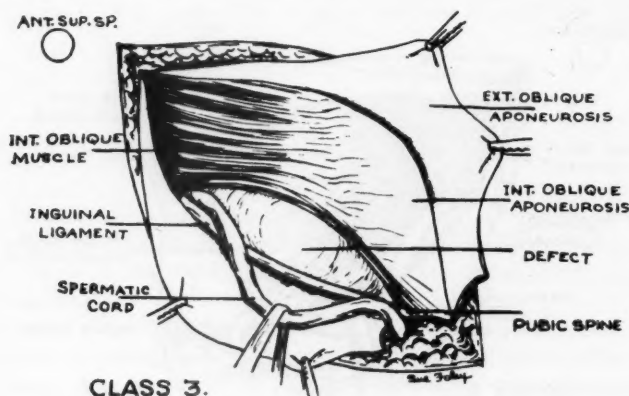
muscle or the transversalis fascia except at the exit of the internal ring where the defect of the indirect hernia is closed. I am of the opinion that this type represents the strongest inguinal region medial to the internal ring.

Class II reveals that the fibers of the internal oblique muscle from their origin arch over the cord at the internal ring and begin immediately to transform or attach into an aponeurosis which follows posterior to the cord and inserts itself into the pubic spine and laterally along the iliopectineal line. This aponeurosis continues upward along the lateral border of the rectus muscle to make up the posterior half of the anterior sheath of the rectus muscle. This conjoined tendon, in some instances, I am sure, is composed of the aponeurosis of the internal oblique and the transversalis abdominis muscle.

Class III reveals that after the fibers of the internal oblique arch over the cord at the internal ring, they change into an aponeurosis which may or may not consist of the transversalis aponeurosis and the internal oblique aponeurosis which together form a conjoined tendon. These fibers arch higher than usual and then turn down to insert into the pubic spine following along the lateral border of the rectus muscle forming the posterior half of the anterior sheath of the rectus muscle. This produces a weakened triangle lateral to the rectus muscle and the pubic spine, and superior to the inguinal ligament, and inferior to the internal oblique and conjoined tendon.

This type of defect predisposes to a direct inguinal hernia and, in my opinion, always should be repaired.

Class IV contains a variation of the foregoing in that it reveals that the fibers of the internal oblique muscle arch over the cord at the exit of the internal ring but do not insert themselves into the pubic spine. Neither do they form the entire posterior half of the anterior sheath of the rectus muscle. These fibers continue to form the lowermost edge of the posterior half of the anterior sheath of the rectus muscle varying from a short distance to a distance of $2\frac{1}{2}$ inches from the pubic spine to the lowermost edge of this described sheath. In this type



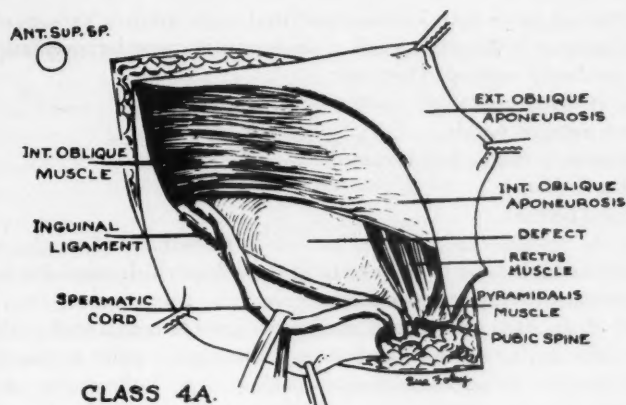


FIG. 4a

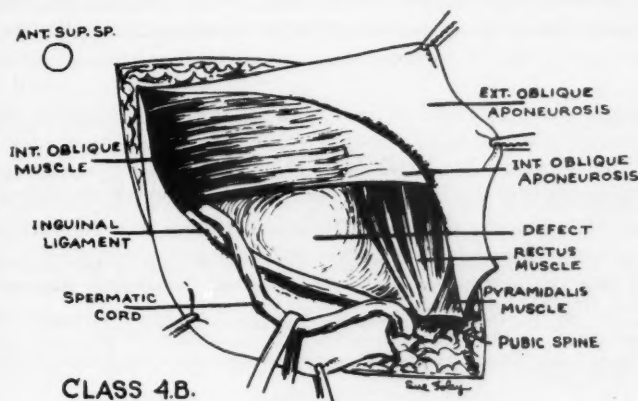


FIG. 4b

the rectus muscle itself has no posterior half of the anterior sheath at its lower end. When the aponeurosis of the external oblique is lifted, the fibers of the rectus muscle may be seen to emerge from underneath the posterior half of the anterior sheath of the rectus muscle and to continue downward for varying distances to the symphysis. They lie posterior to the aponeurosis of the external oblique and insert into the symphysis itself. This represents the weakest anatomy found in this region and, in my opinion, always should be repaired.

When these four anatomic classes with respect to the above described triangular area are combined it is found that the longer the defect on the medial side of the triangle, the weaker the area.

In this type it is more difficult to obtain structures to support the peritoneum and rudimentary transversalis fascia, which may or may not be present.

These findings agree with Lichtenstein⁴ that there are five varieties of hernias which may appear in the groin. Each of these varieties must be specifically sought out and specifically treated. They are:

1. Indirect inguinal hernia.
2. Direct inguinal hernia.
3. Pantaloon or saddle-bag hernia.
4. Sliding hernia.
5. Femoral hernia.

I am of the opinion that repair of hernias in Hesselbach's triangle, or the so-called direct hernias, must be tailored to fit the defect which exists due to absence of either muscle, fascia, or aponeurosis.

Because of the high incidence of combined types of hernia within this region (19.2 per cent in this series), it behooves us to always place a finger into the peritoneal cavity—either through the opening of an indirect sac or through an opening in the peritoneum made explicitly for palpation and palpate the areas which are susceptible to hernia. If this is done unfailingly, we shall be less apt to leave a weakened area or to overlook a small already preformed sac which may develop into a hernia of an entirely different classification to the one just repaired.

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A NEW EXTERNAL CUTTER IN VARICOSE VEIN SURGERY

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An improved technic in varicose vein surgery consists of extraluminal cutting over an intraluminal guide, and complete excision of the diseased superficial veins. This extraluminal cutting is accomplished by an instrument introduced by one of us (W. T.).⁵ A cylindrical cutting head 1 cm. in diameter has been mounted on a long shaft (fig. 1). For comparative purposes, a study of a series of 400 vein operations was made with the new cutter being used in the last 125 extremities.

The treatment of primary varicose veins has evolved through many different technics. It is now well established^{2,3} that the optimum treatment is high saphenous ligation with securing of the tributaries and removal of the diseased superficial veins.

Various methods of removal are used, such as direct surgical excision,⁴ intraluminal stripping,⁶ and extraluminal stripping.¹ These technics are not antagonistic, but are complementary. It is sometimes advantageous to use more than one technic in a particular patient depending on the friability and tortuosity of the veins.

Prioleau⁴ has advocated clearly what must be accomplished: complete removal of the diseased superficial veins. He does this by direct dissection through multiple transverse incisions.

Various types of intraluminal and extraluminal strippers have been introduced and have been widely used. We wish to present a combination technic which uses the extraluminal cutter over an intraluminal guide.

Any one of the acceptable flexible intraluminal strippers is inserted into the vein first and used as the guide. The ends are brought out through incisions at the groin and ankle. Then the extraluminal cutter is passed over the vein and cleanly divides the communicators and perforators at their junction with the main saphenous trunk (fig. 2). This permits easy removal of the entire vein from the groin to the ankle. The hazard of deep venous thrombosis and mutilation of long segments of vessels by blunt avulsion is avoided by the sharp cutter. Remaining venous variations are removed by direct dissection and excision.

The technic of combined extraluminal cutting over an intraluminal guide: Preoperatively, with the patient standing, all of the varicosities and main saphenous channel are outlined on the skin from groin to ankle with an insoluble skin marking ink. General or spinal anesthesia is used and the entire lower extremity

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FIG. 1

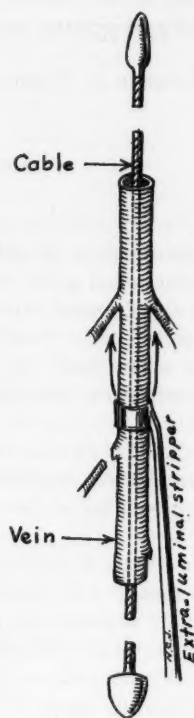


FIG. 2

FIG. 1. Extraluminal vein cutter
 FIG. 2. Combined technic: extraluminal cutter over an intraluminal guide

prepared. The table is placed in 20° Trendelenburg position to empty the veins. An incision is placed along the crease of the groin using the femoral arterial pulsation as the lateral landmark. The saphenous vein is isolated, divided between clamps, and the proximal end lifted from its bed for dissection to the bulb. All individual branches are divided and ligated. The saphenous trunk is doubly ligated at its junction with the femoral vein. The second ligature is of the transfixion type. The fossa ovalis is closed with a purse-string suture as an added buttress over the ligation site and also to serve as a barrier against the deep spread of the now rare superficial wound infection.

An intraluminal cable⁶ is introduced distally down the lumen of the greater saphenous vein. When it reaches the medial malleolus, a transverse incision is made and the tip of the cable extracted.

The extraluminal cutter is introduced over the vein and the guide from below upward with a rotating motion and the tributaries and other attachments are cleanly divided (fig. 2). The extraluminal cutter is also passed downward over the vein and guide until the vein is completely detached. The vein is then withdrawn with the intraluminal guide.

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When passing the guide down the greater saphenous, frequently it impinges in torturous segments below the knee. If this occurs, a transverse incision is made and the tip of the stripper extracted. The vein is then removed in two segments, the first from the proximal portion of the saphenous to below the knee. In order to remove the lower segment, a transverse incision is made at the medial malleolus exposing the distal portion of the saphenous vein which is again threaded on the cable to the knee. The vein cutter is again introduced over the guide from below upward and with a rotating to and fro motion it cleanly divides the tributaries and communicators. The cutter also detaches the skin cleanly from the vein if it is adherent.

Care must be taken not to injure the saphenous nerve which runs parallel to the vein in the ankle. Besides the stripping out of the main trunk, there usually are varicose tributaries or "blow-outs" which are individually excised. Cotton sutures are used throughout. A pressure dressing is applied from the toes to the groin. The patient is encouraged to walk the next day.

DISCUSSION

The combined technic of intraluminal stripping and extraluminal cutting with complete excision has the following advantages:

1. Reduced operating time.
2. Reduced anesthesia time.
3. Both extremities can be treated at one time.

Since in two-thirds of our patients bilateral varicose veins were present, completing the treatment in one procedure is important.

4. Quick removal of the saphenous trunks by stripping leaves operating time for direct dissection and excision of remaining venous variations.

From the number of different techniques that have been proposed in the literature, the impression may have been given that the various operative technic in varicose vein surgery are antagonistic. On the other hand, they are complementary, and all should be available.

SUMMARY

A technic using a new extraluminal cutter over an intraluminal guide supplemented by direct excisions is recommended in the surgical treatment of primary varicose veins.

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THE ROLE OF SURGERY IN THE MANAGEMENT OF THE LATE VAGINAL RECURRENCE FOLLOWING IRRADIATION AND/OR SURGICAL TREATMENT OF CARCINOMA OF THE UTERINE CERVIX

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Prior to 1947, when Meigs⁵ reintroduced surgery in the treatment of carcinoma of the cervix, this disease was treated in this country by irradiation alone. Surgery was never used, either originally or for recurrences. Before the renaissance of surgery in the treatment of carcinoma of the cervix, the treatment of recurrent disease after irradiation remained within the domain of the radiotherapist. During that era, patients who developed recurrent disease after irradiation were classed as therapeutic discards and their condition was considered hopeless. Although retreatment with irradiation was considered the only possible therapy for recurrent disease, the results were not considered uniformly good. This is understandable when it is appreciated that once maximum irradiation fails to cure, secondary irradiation is apt to remain sublethal to the same tumor. The factors of irradiation-induced resistance in the tumor and some degree of permanent damage in normal tissue caused by the initial therapy preclude further treatment. When more vigorous efforts were made to eliminate postirradiation recurrence by using doses in excess of those previously given, the results were worse.

Soon after the advent of surgery in the treatment of carcinoma of the cervix, it became evident that the surgeon occupied a position similar to that of the radiologist in that he was faced with the problem of dealing with recurrent disease after surgery. The development of more radical surgical techniques^{1,2,4} and a better knowledge of what could be accomplished with surgery, coupled with the poor results obtained by retreatment with irradiation, led to the extension of surgery into the treatment of recurrent disease following irradiated cervix carcinoma. Regardless of the method of therapy now used in carcinoma of the cervix—whether surgery or irradiation—some recurrences will follow and will require treatment.

From the viewpoint of the surgeon, the problem in dealing with the recurrence is mainly one of selecting the type of surgery best suited to the immediate situation and at the same time providing maximum future coverage for the patient. This study is a preliminary report on the results obtained in the treatment of 14 patients with vaginal recurrence after irradiation and/or surgery for carcinoma of the cervix, and was undertaken with the objective of assisting the surgeon

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with this problem. Included in this report are a brief description of forms of therapy (surgery and irradiation) previously used and the date of appearance and location of the recurrent carcinoma.

Material and Method: In this report the term "vaginal recurrence" is used, for the sake of convenience, to denote a vaginal lesion occurring in a patient who has had cervix carcinoma at an earlier date. It is realized, however, that such a lesion may be a new primary carcinoma or metastatic carcinoma of the cervix. In no instance in this series were the vaginal lesions proved unequivocally to be other than metastatic carcinoma.

The 14 patients utilized in this study include cases from the George Washington University Cancer Clinic and from the author's private practice and were selected only in the sense that they were good operative risks. Except in 3 instances all of the patients in this series had developed vaginal lesions after varying intervals following treatment of known epidermoid carcinoma of the cervix. In 3 cases the original diagnosis was carcinoma *in situ* of the cervix. The original elective surgery in 3 cases and the surgery for recurrent disease in all 14 cases was performed by the author.

The clinical data relative to the stage of the disease, the original microscopic diagnosis and previous treatment, as shown in table I, were obtained from the referring physician, the radiologist, and the hospital records where previous admissions were recorded. They are considered accurate. In regard to the vaginal recurrences, the diagnosis was made by biopsy in all cases. In 2 of the 3 cases in which the original diagnosis was carcinoma *in situ*, the histologic slides have been reviewed and are considered accurate. In the third case, while the slides have not been reviewed, the diagnosis was made by a reputable pathologist and is considered reliable.

A description of the method of preparation of the patient for surgery, the surgical procedures employed, and the postoperative care routinely employed³ has been presented in an earlier publication and will not be dealt with here. It should be noted, however, that the term "radical hysterectomy" includes an intra-abdominal lymphadenectomy.

Previous treatment: Various methods had been used in the previous treatment of these patients. Seven patients (1, 4, 9, 10, 11, 12 and 14) had been treated by x-ray irradiation and/or radium. External x-ray therapy and radium to the cervix was the method in 2 cases (1 and 14). One patient (9) with an early Stage I lesion received transvaginal irradiation alone. One patient (11) had received external and transvaginal x-ray irradiation. One patient (10) was treated with external x-ray irradiation alone. Radium applied in a cervical stem was the method of treatment in one patient (12). One patient (4) with *in situ* carcinoma received 2 insertions of radium amounting to a total dose of 2,000 milligrams hours. The second insertion was made after an interval of 6 months. After the second insertion of radium 2 insertions of 6 radon seeds, each 1.5 millicuries, were made at weekly intervals. In 7 patients (2, 3, 5, 6, 7, 8 and 13) surgery had been used—alone in 4 cases (2, 6, 7 and 8) and in combination with postoperative irradiation in 3 cases (3, 5 and 13). Of the 4 patients treated by surgery alone, 3

TABLE I
Summary of clinical data on patients treated for vaginal carcinoma following irradiated and/or surgically treated cervix carcinoma

Initials of Patient, Race and Age at Initial Therapy	Stage, Type and Site of Carcinoma	Date and Type of Previous Treatment	Date of Appearance, Site and Description of Vaginal Lesion	Treatment (Surgery and/or Irradiation)	Surgical Specimen	Miscellaneous Data: Status of Patient; Survival Period from Date of Last Operation; Cause of Death; Etc.
(1) M. M. W 62	Stage II; epidermoid; cervix	7-14-48-8-7-48: full course x-ray; 8-27-48: 2340 mg. hours radium; 9-4-48: 1000 mg. hours radium	Nov. 1948: extensive involvement anterior vaginal wall	1-5-49: anterior exenteration	Ca cervix and vagina	Deceased 2-20-54; 61 months; intercurrent heart disease
(2) L. W. W 36	Stage I; epidermoid; cervix	5-5-49: radical hysterectomy	11-9-49: 0.5 cm lesion, vaginal vault, anterior wall	12-17-49: local excision; 1-1-50-2-16-50: x-ray-200 r (in air) to each of 6 8 X 15 cm pelvic fields	Epidermoid ca, metastatic	Alive and well 1-15-57; 85 months
(3) C. H. C 42	Stage III; epidermoid; cervix	Aug. 1932: total hysterectomy; Oct.-Nov. 1952: x-ray-1700 r external, 2500 r transvaginal	Mar. 1953: 3 cm. mass, right vaginal fornix; fixed mass, left adnexal region; thickening right adnexal region	Apr. 1953: intra-arterial HN2; 5-4-53: total cystectomy; partial vaginectomy; partial colectomy; transplantation of ureters	Epidermoid ca, bladder, vagina and sigmoid colon	Deceased 5-9-54; explored (inoperable) 4-13-54; 13 months; uremia
(4) A. K. W 45	Stage 0; in situ; cervix	July 1951: 1200 mg. hours radium (chronic cervicitis), 1-10-52: 800 mg hours radium (in situ ca); 1-17-52: 6 radon seeds (1.5 mc. each inserted); 3-27-52: 6 radon seeds (1.5 mc. each inserted)	Mar. 1954: recurrence vaginal vault	4-9-54: anterior exenteration; Aug. 1954: x-ray	Ca cervix, right and left parametria; urinary bladder; positive lymph nodes	Deceased 1-5-55; 8 months; uremia
(5) L. W. W 55	Stage I; epidermoid; cervix	1945: subtotal hysterectomy; July 1946: ca cervical stump; 7-4-46: 1200 mg. hours radium; 7-11-46-8-15-46: x-ray-2000 r to anterior pelvis; 2000 r to right and 2000 r to left posterior pelvis; 9-11-46: 5520 r transvaginal	9-10-54: recurrence, anterior and posterior vaginal walls, upper one-third	11-5-54: removal of stump and partial colectomy; transverse oostomy	Recurrent anaplastic epidermoid ca, cervix and vagina, with vascular and lymphatic invasion	Deceased 4-14-55; 5 months; uremia
(6) C. G. C 37	Stage I; epidermoid; cervix	Aug. 1954: radical hysterectomy	Dec. 1954: vaginal recurrence, vault	Dec. 1954: x-ray; Mar. 1955: anterior exenteration	Epidermoid ca, invading vagina, vesicovaginal septum and perirethral tissue on the left side	Deceased 1-25-56; 12 months; uremia; recurrence, vaginal vault and nodes, right groin June 1956

(7) F. I. W 59	Stage 0; in situ; cervix	12-12-51: total hysterectomy	2-22-55: 1 cm. lesion, posterior vaginal wall, upper one-third	3-5-55: intra-abdominal pelvic lymphadenectomy; partial vaginectomy	Squamous ca., either primary or secondary; negative lymph nodes	Alive and well 12-5-56; 10 months
(8) C. C. W 58	Stage II; epidermoid; cervix	2-4-54: radical hysterectomy	Mar. 1955: recurrence, vaginal vault; 3-8-55: recurrence, posterior vaginal wall, lower one-third	4-6-55: partial vaginectomy; abdominal route; 5-9-55: complete pelvic extirpation, one ureter transplanted	Epidermoid ca., wall of bladder, three areas in sigmoid colon and wall of vagina	Alive and well 1-5-57; 9 months
(9) M. H. W 79	Stage I; epidermoid; cervix	June 1951: transvaginal x-ray—6400 r (in air)	5-16-55: recurrence, vaginal vault	5-14-56: exploration; partial resection transverse colon and omentum; biopsy of peritoneum	Metastatic squamous ca. in transverse colon, omentum and parietal peritoneum	Alive with disease Jan 1957; 9 months
(10) H. C. W 68	Stage I; epidermoid; cervix	10-29-39-11-9-38: x-ray—7200 r (in air)	July 1956: 1 cm. lesion, anterior vaginal wall, middle one-third	7-20-56: anterior pelvic extirpation	Epidermoid ca., anterior vaginal wall; massive radiation fibrosis	Alive and well 1-10-57; 9 months
(11) R. W. C 43	Stage I; epidermoid; cervix	11-30-45-1-30-46: x-ray—2000 r to each of five ports; 8000 r transvaginal	10-16-56: 0.5 cm. lesion, anterior vaginal wall, just within introitus	11-4-56: anterior pelvic extirpation	Epidermoid ca., recurrent, anterior vaginal wall; marked radiation effect	Alive and well 1-15-57; 3 months
(12) M. M. W 64	Stage I; epidermoid; cervix	Aug. 1946: x-ray—1188 r; Dec. 1946: 6111.5 mg. hours radium	12-3-55: infiltrating lesion, anterior and right lateral vaginal walls; two lesions, posterior vaginal wall	12-3-56: subtotal hysterectomy; bilateral salpingo-oophorectomy; biopsy, liver; biopsy, vaginal wall	Adenocarcinoma, right ovary, with metastasis to liver, omentum and vagina	Deceased 12-11-56; pulmonary infarction, postoperative
(13) I. L. C 52	Stage 0; in situ; cervix	June 1948: total hysterectomy and bilateral salpingo-oophorectomy; appendectomy; periodic x-ray, external, vaginal and endocervical applicators	Not available	Nov. 1956: exploration and colostomy	None (inoperable)	Alive with disease 1-15-57; 3 months
(14) J. R. W 42	Stage I; epidermoid; cervix	Dec. 1955-Jan. 1956: x-ray—3700 r to each parametrial area; Feb. 1956: 6240 mg. hours radium	12-11-56: 1.5 cm ulcerated lesion, left anterolateral vaginal wall, adjacent to urinary meatus	12-20-56: left inguinal node dissection; partial resection of vagina and distal one-third urethra	Positive inguinal lymph node; epidermoid ca., metastatic	Alive and well 1-15-57; 3 months

Abbreviations: W White; C Colored; mg. milligrams; mco. millicuries

(2, 6 and 8) with Stage I disease had been treated by radical hysterectomy. One patient (7) with preinvasive carcinoma had been treated by total hysterectomy. Both of her Fallopian tubes and both of her ovaries had been removed at an earlier operation. Two patients (3 and 13) had had a total hysterectomy and bilateral salpingo-oophorectomy followed by external x-ray irradiation, and one of these (13) had had additional irradiation in the form of vaginal and endocervical radium. One patient (5) had had a subtotal hysterectomy, followed within 1 year by external x-ray therapy and radium to the cervical stump for carcinoma. Four institutions and 2 individual physicians provided the irradiation therapy reported in this series and described in table I.

In 2 patients (1 and 14) the external Roentgen irradiation factors were: 220 KVP; half-value layer 1 mm copper; target-skin distance 50 cm. Three anterior pelvic fields and 3 posterior pelvic fields, each 8 x 15 cm, were used. In 4 patients (3, 9, 10 and 11) the external Roentgen irradiation factors were: 220 KVP; half-value layer $\frac{1}{2}$ mm copper; target-skin distance 40 cm. The external pelvic ports were 12 and 15 cm. In one patient (5) the external pelvic factors were: 220 KVP; half-value layer 410 mm tin, $\frac{1}{4}$ mm copper and 1 mm aluminum; target-skin distance 50 cm. The fields were 15 x 15 cm.

When transvaginal x-ray therapy was used the Roentgen irradiation factors in one case (5) were: 220 KVP; $\frac{1}{2}$ mm copper filter; target-skin distance 34 cm; 2 $\frac{3}{4}$ cm port; and in another case (9) were: 140 KVP; 8 ma; target-skin distance 24 cm; and 3 mm aluminum filter. In one case (13) the factors concerning the manner of irradiation as well as the dosage are not available. In 2 patients (1 and 14) the radium was applied through the use of a Campbell colpostat. When ready for insertion the colpostat held 65 mg. of radium—25 mg. in tandem in the cervical stem, 10 mg. in each of the cervical bars, and 10 mg. in each vaginal fornix. The filtration was equivalent to 1 mm of platinum. In 3 patients (4, 5 and 12) 50 mg. of radium was applied in tandem through the use of a cervical stem. The filtration was equivalent to 1 mm of platinum. The amount of x-ray irradiation measured in air and dosages of radium expressed in mg. hours received by the patients in this series are shown in table I.

Results: In the 3 patients (2, 6 and 8) treated initially by radical hysterectomy the vaginal recurrences were first noted 6 months, 4 months and 13 months, respectively, after the initial surgery. One of these (2) was treated by local excision, followed by deep external x-ray therapy. She is alive and well 90 months after the surgery. One patient (6) received deep x-ray therapy, followed by an anterior exenteration 4 months later. She died 9 months later with disseminated disease. One patient (6) was treated by a partial vaginectomy performed by the abdominal route. One year later the second recurrence was noted on the lower posterior vaginal wall and a complete pelvic exenteration was performed. She is alive and well 12 months later.

Of the 2 patients (3 and 13) treated by surgery and postoperative irradiation, one (3) had a 3 cm. mass in the right vaginal fornix 7 months later and was treated by an anterior exenteration and partial resection of the sigmoid colon. This patient died 1 year later from advanced disease. In the other patient (13) the

time of recurrence is unknown. She was first seen 8 years and 5 months after the original operation, with extensive vaginal involvement. At exploration the disease was found inoperable, and a palliative colostomy was performed. This patient is alive with disease 6 months later.

In the 7 patients (1, 4, 9, 10, 11, 12 and 14) treated by irradiation vaginal lesions were noted in 2 months, 24 months, 54 months, 216 months, 130 months, 120 months and 10 months, respectively, after the original treatment. Four patients in this group (1, 4, 10 and 11) were treated by anterior exenteration. One (1) survived 60 months and died from intercurrent heart disease; one (4) received additional postoperative x-ray therapy and died from uremia 8 months after the surgery; and 2 (10 and 11) are alive and well 6 months and 3 months, respectively, after the surgery. One patient (9) was found to have inoperable disease and her condition was palliated by partial resection of the transverse colon, resection of the omentum and the establishment of a permanent colostomy. She is alive with disease 10 months after the surgery. One patient (12) was found to have advanced disease and extensive involvement of the liver from ovarian carcinoma. The vaginal extension in this patient was of similar histologic pattern to that shown in the liver metastasis. This patient's postoperative death, which occurred on the tenth postoperative day and resulted from pulmonary infarction, was the only postoperative death in this series. One patient (14) was treated by wide local excision of the vaginal lesion and a unilateral groin dissection. She is alive and well 4 months after the surgery. One patient (7) treated by an intra-abdominal pelvic lymphadenectomy and partial vaginectomy is alive and well 12 months after the operation. One patient (5) treated by removal of the cervical stump and partial vaginectomy died 5 months later from uremia.

The results of this study may be summarized as follows: of the 14 patients treated, 6 are alive and well at 85 months, 10 months, 9 months, 6 months, 3 months and 3 months, respectively, after the surgery; 2 are alive with disease at 10 months and 4 months after the surgery; 5 are dead at 61 months, 12 months, 8 months, 5 months and 12 months, respectively, after the surgery. There was only one postoperative death.

DISCUSSION

In this study an effort is made to gain some insight into the problem of the vaginal recurrence, following irradiated and/or surgically treated carcinoma of the cervix and to determine what can be accomplished by surgery in this type of recurrence. While the series is too small to permit the formulation of valid conclusions and too little time has elapsed to predict the final results, this study does provide a medium for focusing the attention of the profession on several aspects of this problem.

The clinical data reviewed in this report show that vaginal recurrence may develop at any time from 4 months to 18 years following irradiation and/or surgically treated carcinoma of the cervix. The longest interval after surgery for the development of the recurrence in this report was 5 years and after irradiation 18 years.

For the early appearing vaginal recurrence, such explanations as inadequate treatment, retrograde lymphatic spread and surgical seeding may be valid. For the lesion that develops after an interval of several years, however, these explanations fail to satisfy and the true explanation is not forthcoming. In this respect the development of vaginal recurrence is not unlike the history of epidermoid carcinoma of the oral cavity, which has a tendency to recur long after the primary lesion has been controlled. These facts tend to support the belief that carcinoma is multicentric in origin, certainly in tissues of similar histologic structure and with a common underlying physiology. Added support for this theory has been presented by Newman⁶ who reported a close relationship between Bowen's Disease and *in situ* carcinoma of the vulva and carcinoma of the cervix. Of the 9 cases in Newman's series with vulvar lesions 2 died from epidermoid carcinoma of the cervix and 7 revealed preinvasive carcinoma of the cervix.

In any event, recognition of the fact that vaginal lesions can develop one or more times after treated carcinoma of the cervix suggests the employment of surgery, with or without irradiation, as the method best adapted to the problem of treatment of the vaginal recurrence. Except in 3 instances, as shown in table I, surgery alone was the method of treating the recurrences in this study. In the 3 exceptions, 1 patient was treated by local excision and postoperative x-ray therapy, 1 received x-ray therapy followed by radical surgery, and 1 received x-ray therapy after radical surgery. The patient treated by local excision and postoperative irradiation has survived a longer period after the surgery than any other patient in this series. She is alive and well 90 months after the surgery.

To some extent the location and size of the recurring lesions determine the type of surgery employed. This was true for the 2 patients in this series treated by partial vaginectomy—alone in one case and with an intra-abdominal lymphadenectomy in the other. One of these patients developed a second recurrence 1 year later and was treated by a total pelvic exenteration.

To a greater extent the patient's decision in accepting or refusing radical surgery determines the manner of treatment. One patient in this series was treated by wide local excision and a unilateral groin dissection because she refused radical surgery.

Three patients in this series with small local lesions were found, upon surgical exploration, to have widespread disease. One of these (12) requires special attention. She had received external x-ray therapy and radium in 1946 for an epidermoid carcinoma of the cervix. Ten years later this patient was found to have an infiltrating lesion on the anterior vaginal wall. Prior to the time of the surgery a biopsy had not been obtained from the vaginal lesion because it was thought to be recurrent disease from carcinoma of the cervix. Exploration of the abdominal cavity, however, revealed ovarian carcinoma with metastasis to the liver. The vaginal lesion was metastatic ovarian carcinoma.

It has been learned from this study that patients can develop more than one vaginal recurrence after treated carcinoma of the cervix and that occasionally the patient who has a vaginal recurrence, although it may be small and seemingly

localized, may have, in addition, internal disease. It would seem, therefore, that radical surgery is the desirable form of therapy when recurrence is first noted.

SUMMARY

The results obtained in the surgical management of 14 patients with vaginal recurrences following irradiation and/or surgical treatment of carcinoma of the uterine cervix have been presented.

Additional data included in this report are a brief description of forms of therapy (surgery and irradiation) previously used and the date of appearance and location of the recurrent carcinoma.

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ILEAL ATRESIA

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Atresia of the ileum, although relatively rare, continues to be one of the most grave surgical conditions of the newborn.

Embryologically, the intestinal tract passes through a stage of patency which persists until the fifth week. At this time epithelial proliferation obliterates the lumen and it is not until about the twelfth week that vacuoles appear and begin to re-establish a patent canal. It would seem likely that some embryologic mishap occurs between the fifth and twelfth weeks in most cases of atresia of the bowel. Whether this mishap is due to infection, arterial change, kinking of the intestine, or other cause is unknown (fig. 1).

The area of atresia may assume several forms. There can be complete discontinuity of bowel with a blind sac and a mesenteric defect, or there can be a fibrous cord joining the blind, distended portion to the distal collapsed segment. The atresia may be due to a membrane of tissue within the wall of the ileum and in some cases the apparent atresia may prove to be a tight form of ileal stenosis which has become a functional atresia. The incidence of multiple areas of atresia (approximately 15 percent)⁸ is sufficient to require special note. No competent surgeon would want to treat an area of atresia until he had examined the entire bowel for additional areas of obstruction (fig. 2).

In our clinical experience, the warning signs and symptoms of ileal atresia have not been evident quite as early as other writers have stated. While most duodenal atresias have been diagnosed in the first 24 to 48 hours because of early vomiting, ileal atresias are usually not detected (or even suspected in some cases) before the third or fourth day. Progressive generalized abdominal distention, listlessness, effortless regurgitation, and obvious dehydration, associated with respiratory distress, all indicate a critically ill infant. Obviously the higher the atresia, the earlier the vomiting, and the less dramatic the abdominal distention. The vomitus is of a rather foul, fecal character which is apt to appear at any time and is not necessarily associated with feeding. The baby lacks the eagerness for sucking which is present in pyloric stenosis or duodenal obstruction.

The passage of stool on two or three occasions may be misleading. The meconium is usually less fluid, more gray in color, and scanty in amount; however, repeated rectal examinations and temperature takings often lead to notations on the nursing sheet which would seem to indicate multiple bowel movements.

The gradual dehydration eventually leads to marked elevation in temperature and may serve as a first indication of perforation of the tremendously distended blind sac.

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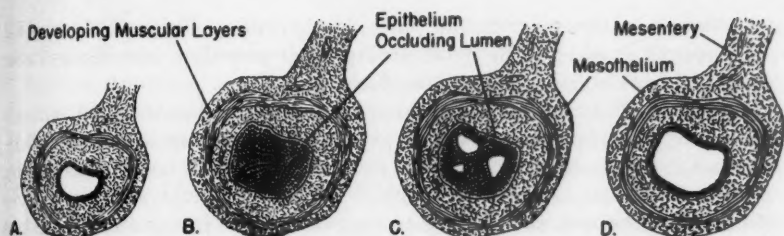


FIG. 1 Embryologic development of the small bowel after Patten. A. Up to 5 weeks of embryonic life. B. Epithelial proliferation to complete obliteration of lumen, approximately 6 to 11 weeks. C. Appearance of vacuoles, twelfth week. D. Re-establishment of patent intestinal canal.

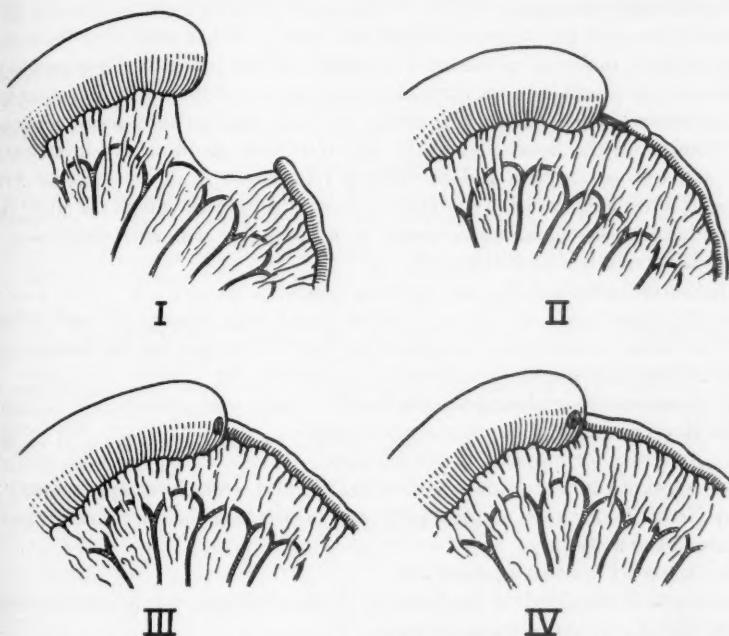


FIG. 2 Forms of ileal atresia in the newborn. I. Atresia with complete discontinuity of bowel and mesenteric defect. II. Atresia with fibrous replacement of intestine. III. Atresia due to intrinsic diaphragm. IV. Ileal stenosis converted to functional atresia by obstruction of lumen.

Roentgenologic examination of the abdomen in both the prone and upright positions will usually confirm the clinical suspicion and expedite surgical correction. The use of contrast media is usually unnecessary and necessitates unwarranted delay in treatment.

Since surgery is the only therapy for these patients, the preoperative preparation must be judicious, and should consume the shortest time possible to attain

the maximum improvement in the patient's physical condition. The surgical treatment itself should provide the shortest possible procedure with the quickest relief of obstruction and re-establishment of oral feedings.

Use of the Isolette incubator has many advantages in handling the infant's nursing care, providing economical oxygen therapy, together with humidified, filtered air at the desired temperature to stabilize the infant's body temperature.

An immediate intravenous "cut-down" followed by fluid and electrolyte replacement is the next step. Nasogastric suction of the intermittent type has proved most effective. Typing and cross-matching of blood, institution of antibiotics, vitamin K and C, are all essential steps.

At the operating table, the presence of a qualified anaesthesiologist is the greatest aid. The choice of anaesthetic agents should rest solely with the man who is administering them.

During the past few years our operative treatment has been directly related to the critical condition encountered in most of these patients. To improve our mortality and morbidity, we have almost routinely adopted the Mikulicz type of exteriorization procedure with crushing of the spur as soon as possible and early closure of the ileostomy. While this routine is aesthetically unattractive to a well trained surgeon and completely repugnant to an enthusiastic house officer, the results have been so dramatic that it is hard to defend the more time consuming resections and anastomoses, with the higher mortality entailed.

Advantages of this procedure are:

- (a) Shorter operating time and quicker relief;
- (b) An opportunity to dilate the distal bowel with mineral oil and peroxide after the initial procedure is completed in order to prepare for the fecal stream;
- (c) A relatively aseptic procedure;
- (d) Greater ease in closing the abdomen.

The disadvantages of the procedure include:

- (a) Necessity for meticulous nursing care;
- (b) Necessity for constant attention to fluid and electrolyte replacement;
- (c) Necessity for good surgical judgment in selecting the appropriate time for closure of the ileostomy;
- (d) A second operative procedure;
- (e) Hazards involved in application of the crushing clamp and theoretical possibility of volvulus around the spur.

Postoperatively the use of nasogastric suction until the return of active peristalsis is imperative. Following this period, a type of infant feeding should be selected which gives a minimal curd. The frequent stimulation of the patient by digital rectal examinations is apparently helpful in promoting bowel movements and decompression.

DISCUSSION

The reports in the literature on the treatment of ileal atresia by routine anastomosis, indicate rather disappointing results. The experience of Gross without the use of the Mikulicz spur is an example. In the series at the Boston

Children's Hospital employing the spur, 14 survivals against 6 deaths is in marked contrast to 7 survivals and 11 deaths by primary anastomosis.

Improved nursing procedures, laboratory facilities, and meticulous attention to fluid balance and antibiotics, undoubtedly have all contributed to the revival of the Mikulicz procedure.

SUMMARY

Ileal atresia is one of the most grave surgical emergencies of the newborn infant.

The critical condition of these infants precludes, extensive surgical procedures if survival is to be achieved.

The Mikulicz type of exteriorization with early crushing of the spur and early closure of the ileostomy offers these infants the greatest opportunity of survival.

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PROBLEMS OF PORTAL HYPERTENSION

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Despite the progress which has been made in the treatment of patients with portal hypertension, there are still many problems to be solved. Many difficulties arise during the management of these individuals in the preoperative phase, and some may result from the very procedure which has been designed to relieve them. The purpose of this communication is to catalogue these problems and suggest means by which they may be overcome or ameliorated.

Diagnosis: The sources of massive upper gastrointestinal hemorrhage have been emphasized repeatedly^{3, 10, 22, 47, 52, 55, 72}. One source which often is not considered is the gastric varix⁶⁰. This is an infrequent complication, reported in only 2 per cent of patients with upper gastrointestinal tract hemorrhage⁶³. This entity may divert attention from portal hypertension, and, in the presence of effective tamponade of the esophagus, may create confusion and a false sense of security regarding the bleeding site. To arrive at a correct diagnosis, there is no substitute for a rapid but thorough history and physical examination. The stigmata of cirrhosis may be present or may be completely absent in infants or young children. The palpation of an enlarged spleen should focus attention on the portal system²⁷. Emergency laboratory tests which have been most helpful are a bromsulphonphthalein test, prothrombin time, and the determination of the blood ammonia level³⁶. Little aberration in these tests will be found when there is extrahepatic obstruction.

Emergency barium studies are usually unrewarding since decrease of pressure in the portal system may cause collapse of the varices and the admixture of blood and barium in the esophagus and stomach gives rise to bizarre shadows which defy accurate interpretation.

Emergency treatment of acute massive bleeding from varices: 1. Nonoperative; The administration of freshly drawn whole blood¹⁰ should proceed hand in hand with the placement of a tube which will effect pneumatic esophageal tamponade. Such a tube not only controls hemorrhage, but is a most reliable differential diagnostic aid as well. The double balloon tube is superior to the single balloon tube, since the lower balloon not only compresses the veins at the junction of the esophagus and stomach, but also anchors the tube securely and prevents displacement of the esophageal balloon⁵⁰, which, if displaced, may cause interference with the airway.

When tamponade is effective, bleeding, if variceal in origin, will be promptly controlled, and the gastric aspirate will clear. If, however, the gastric aspirate remains bloody, the bleeding is arising in the stomach from a gastric varix or

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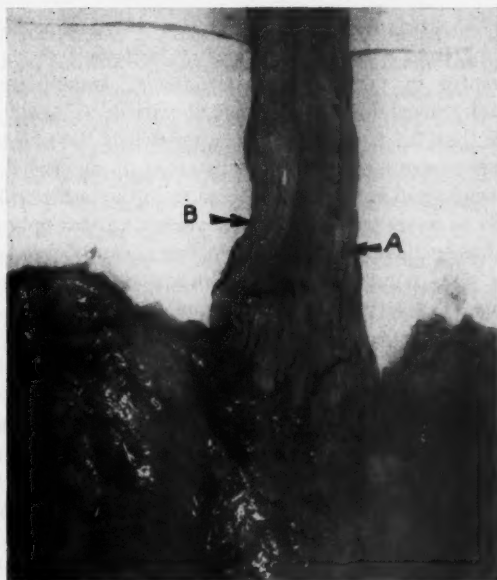


FIG. 1. Esophagus after 48 hours of continuous tamponade showing. A. Superficial erosions. B. Edema.

from other gastric or duodenal lesions. Some patients will rebleed after successful tamponade. Long continued tamponade of the esophagus results in superficial erosions, inflammation, and edema⁸ (fig. 1), which increase the hazard of operative intervention. Therefore, our original method of management⁴⁹ has been revised. The first 24 hours following the initial bleeding episode has been divided into six 4 hour periods rather than two 12 hour periods. If bleeding has been controlled after 4 hours of tamponade, pressure in the upper balloon is released and the gastric aspirate observed. If bleeding does not recur, the pressure in the lower balloon is released at the end of 8 hours. The tube is left in place for continued aspiration of the stomach, and for transport of saline cathartics to accomplish rapid elimination of blood from the gastrointestinal tract⁷³. This will prevent bacterial decomposition of the blood and the consequent liberation and absorption of large amounts of ammonia which the diseased liver is unable to conjugate. If there is no evidence of hemorrhage at the end of 24 hours, the tube is removed. This modified method of management has to some extent overcome the hazard of an inflamed edematous esophagus which may have to be approached surgically if tamponade fails. If bleeding occurs twice in the initial 24 hour trial of tamponade, operative intervention is imperative. The possible exception to this concept is that group of patients classified as "dead-end" cirrhotics. Operative intervention in this group has resulted in a prohibitive mortality, so that tamponade should constitute the most effective mode of treatment, and should be continued for a number of days if need be.

2. Operative; No satisfactory emergency operative technic has been devised to control bleeding from esophageal varices^{4, 6, 39, 51, 53, 56, 59, 64}. The operative procedures currently in vogue are two, namely; transthoracic ligation of varices^{7, 14, 35}, and transabdominal ligation of varices^{13, 71}. Our experience has led us to believe that the transabdominal approach is the one to be preferred. The bleeding varices are usually located in areas of superficial erosion at the junction of the esophageal and gastric mucosa or in the last 4 or 5 centimeters of the esophagus. It is necessary to ligate or oversew varices only in this circumscribed area. It has been shown that the esophagus can be freed up to the same extent below the diaphragm as it can be above, and suture ligation carried out with equal facility. The suture line in the esophagus is excluded from the chest and there is opportunity to deal with gastric or duodenal lesions if the original diagnosis has been in error. This procedure has been better tolerated in poor-risk patients¹³. When there has been previous surgery in the left upper quadrant of the abdomen, i.e. splenectomy or splenorenal shunt, our preference is for the transthoracic approach.

Following the control of bleeding, these patients are a problem for a medical surgical team. Gastric acidity is controlled by the use of atropine-like drugs. To diminish the likelihood of reflux esophagitis which may trigger rebleeding episodes, patients are required to assume a semisitting position at all times. Morphine is contraindicated, and barbiturates should be given cautiously⁶². The poor function of the liver causes slow conjugation of these drugs, and a dose considered small, will result in long and frightening periods of somnolence. The dietary protein must be titrated against the blood ammonia level to prevent the insidious onset of hepatic coma^{20, 65, 74}. Fresh whole blood and Vitamin K are administered as needed. The criteria of operability are well emphasized and the optimum condition of these patients may not be reached for a period of 6 weeks to 3 months³⁴. The initial surgical approach on the varix bearing area should never be interpreted as definitive, since some type of vascular shunt procedure is necessary to decrease the elevated pressure in the portal system.

Elective treatment: It is generally agreed⁴⁵ that some type of shunt between the portal system and the inferior vena cava or its branches is necessary to reduce increased pressure in the portal system. At the time of operation pressures should be measured in some tributary of the portal system before and after the performance of a veno-venous shunt. In order to accurately assess the normality or abnormality of the portal system, operative splenoportograms and portaportograms should be obtained^{1, 11, 18, 21, 46, 66}. There has been some enthusiasm for percutaneous splenoportograms, but this is attended by increased hazard from bleeding as a reflection of increased pressure in the portal system^{16, 48, 57}. If the latter procedure is performed at a time other than at laparotomy, it should be done immediately preceding surgery. Portagrams will frequently indicate the optimum site for the performance of the shunt and save much tedious dissection.

Bleeding varices present the same difficulties in both adults and children. However, the small size of the vessels in children make it difficult to fashion an

adequately functioning shunt²⁷. If a shunt can be fashioned, there is considerable doubt as to its long continued patency, not only because of the small size but the tendency to thrombose after pressure in the portal system has diminished. There has been speculation concerning the procedure best performed in children. One fears not to construct a shunt, and yet the small caliber of the shunt is cause for misgiving. We have attempted to effect a compromise which will afford a measure of protection to these children from rebleeding episodes, but will not render more difficult the later performance of a shunt when the child and his vessels have attained a more adequate size. Two years ago we cared for a 3 year old child bleeding from varices. Her condition was too poor to permit a prolonged procedure. We therefore ligated the left gastric and splenic arteries, hoping thereby to diminish arterial flow into the portal system, but the splenic and portal vein were preserved for a future shunt procedure. She has done well for 2 years with only 2 minor bleeding episodes during this period.

The types of vascular shunts presently advocated for the relief of portal hypertension are:

1. The Eck fistula (distal end of the portal vein to the side of the inferior vena cava) resulting in the complete diversion of portal blood from the liver.

2. The spleno-renal shunt (end of the splenic vein to the side of the left renal vein) removing the spleen with abolition of its reservoir function and disruption of spontaneously formed collaterals between the upper pole of the spleen and the diaphragm along with the increased tendency to thrombosis⁶⁶.

3. The side to side portacaval anastomosis (the side of the portal vein anastomosed to the side of the inferior vena cava or false Eck fistula) with only partial diversion of portal blood from the liver leaving the spleen and its associated collaterals intact.

We advocate the side to side portacaval anastomosis. It has been demonstrated that there can be no regeneration of liver tissue in the absence of portal blood^{27, 38}. Moreover, there is an increasing number of patients who have adequate lowering of the portal pressure by the Eck fistula anastomosis, but who have been crippled physiologically in their ability to adequately conjugate the products of protein metabolism i.e., ammonia⁴². Those who favor this type of shunt argue that no portal blood reaches the liver because of the extensive fibrosis in this organ, and that a side to side portacaval anastomosis may actually provoke a reverse flow of blood from the hepatic artery to the portal vein and thence to the inferior vena cava, resulting in a lesser amount of blood available to the liver¹¹. This has not been proven in our recent experimental studies⁵⁰ which showed that complete portal diversion with liver damage and high concentrations of circulating ammonia was incompatible with survival. The spleno-renal shunt is more difficult to perform because of: 1. The tedious dissection necessary to obtain an adequate length of splenic vein; 2. It may be necessary to have a vein graft available; 3. Existing shunts between the spleen and the diaphragm are disrupted; 4. The reservoir function of the spleen is abrogated⁵; 5. The fate of a vein graft in the face of lowered pressure is well known²⁸. The

Eck fistula results in complete diversion of blood from the liver denying regeneration in this organ, and directing products of metabolism into the general venous circulation.

Hepatic Coma: There are increasing reports of so-called hepatic coma (meat intoxication) which occur following the performance of an Eck fistula^{11, 19, 24, 25, 26, 41, 66}. It has occurred in individuals with no liver disease as a result of complete portal diversion at the time of radical surgery for pancreatic carcinoma^{40, 43}. These episodes of coma occur in the immediate postoperative period as either a terminal event, or as repeated transient episodes. Conversely, only four instances of fatal hepatic coma occurring after side to side portacaval anastomosis are documented in the literature^{30, 33}. In our series of more than 50 patients there has been one instance of fatal hepatic coma in the immediate postoperative period and two instances of transient coma following the side to side portacaval type of shunt.

The response to high levels of ammonia caused by injection of urease into dogs with rapid conversion of urea into ammonia has been interesting and informative. The Eck fistula was created in one group of these animals with complete diversion of portal blood. Liver damage was experimentally produced by the daily administration of carbon tetrachloride for a period of 4 to 6 months. The second group of dogs had a side to side portacaval anastomosis performed and liver damage was produced in the same fashion as with group one. With identical doses of intravenous urease (75 Sumner units) the Eck fistula animals routinely died in hepatic coma in 3 hours, and the animals having the side to side portacaval anastomosis routinely survived⁵⁰. Although it is hazardous to apply results obtained in animal experiments directly to human beings, these consistently reproducible findings in the dog should offer a stimulus for careful scrutiny of individuals with episodes of hepatic coma following a shunt which has resulted in the complete diversion of portal blood from the liver.

Regardless of the type shunt performed, all such patients should have the blood ammonia checked at monthly intervals. While still a subject of considerable debate^{9, 20, 43, 54, 58, 65, 69, 74}, rising ammonia levels in this series of patients has been of grave import, and no patient has developed frank coma where the blood ammonia level has been below 300 gamma per cent (normal 48-72 gamma %)⁷⁶.

The onset of hepatic coma is notoriously subtle, and early signs are difficult to evaluate. At times these patients may remind one of a mildly intoxicated individual. They may also appear slightly confused, lackadaisical, and may exhibit unusual behavior. A blood ammonia will usually define this condition and energetic measures necessary to ward off impending or frank coma can be instituted.

In impending coma the speech is slurred. The patient will respond to commands but will be extremely hazy and vague in answering questions. Tremor is usually present, and at times a flapping tremor of the upper extremities may be elicited (liver flap). Confusion between this state and delirium tremens is frequent. This

state may persist for periods varying from a few hours to several days before frank coma ensues.

The stage of frank coma is usually manifested by the patient lying quietly in bed as though asleep. He can be aroused with difficulty if at all, and there is usually a diminution of urinary output. Fever and jaundice may supervene. These patients die quietly with no findings at post mortem other than a cirrhotic liver. Their exodus may be hastened by a final massive bout of hematemesis.

The best treatment for coma is prophylaxis¹⁵. We have been careful to obtain blood ammonia levels in all patients who have been candidates for shunt procedures and have followed them carefully at stated intervals in the postoperative period. If a patient preoperatively has a blood ammonia greater than 100 gamma per cent, he is a poor candidate for total portal diversion. If during the pre- or postoperative period these patients have a blood ammonia level greater than 150 gamma per cent, we institute treatment for impending coma. Morphine is not used since the degree of liver function may be so depressed that these patients will sleep for long periods on very small doses¹⁵. Probably only small doses of the short chain barbiturates should be used if sedation is indicated¹⁵. The intake of protein should be reduced to 45 grams a day (the usual daily hospital allowance is 90 grams) and the addition of 25 grams of Monosodium Glutamate (Zest or Accent) to food or fluid taken will aid in the conjugation of excesses of circulating ammonia^{15, 29, 31, 32, 42, 67, 70, 75}. It has been shown that there need be no restriction of protein if Neomycin in the amount of 12 grams daily is given²³. This drug would appear to block the formation of ammonia in the gastrointestinal tract by its sterilizing action on the bacterial flora usually present. This is too costly for more than a few patients. Using this regime blood ammonia levels have decreased and the condition of the patients has markedly improved. There is a group of our patients who carry a sustained elevated ammonia level and usually get into difficulty at the time of ingestion of large amounts of protein. These patients are given 25 grams of Monosodium Glutamate daily with their meals, and this has proved effective in preventing transient episodes of coma for periods of 18 to 24 months.

Arginine Hydrochloride apparently is more effective in the treatment of frank coma than Monosodium Glutamate, although we have only recently begun its use. It does not contain sodium which to the cirrhotic patient in coma is a distinct advantage^{43, 44}.

"Dead-end" Cirrhotics: This is an unfortunate group. Liver functions are poor, ascites is present, and this sad picture may further be complicated by the onset of massive hemorrhage. This group tolerates anesthesia poorly without the added insult of any surgical procedure. Our mortality with transesophageal ligation in these patients is 50 per cent due to poor healing of the esophageal suture line and resulting mediastinitis. There is no procedure which is tailored for these people.

A group of surgeons in the Netherlands after a series of animal experiments have advocated the ligation of one of the hepatic ducts as a means of providing a



FIG. 2. Portaportogram showing cavernous transformation of the portal system.

stimulus for regeneration of the remaining unobstructed portion of the liver⁶. The obstructed portion of the liver becomes atrophic but there is regeneration of liver tissue in the unobstructed portion. They have reported good results in one patient with the complications of bleeding and ascites. We have performed the procedure in one patient who had poor liver function, bleeding and ascites. The left hepatic duct was ligated and the patient did well for approximately 7 days after operation, after which she lapsed into coma and died. It is this type of procedure which must be thoroughly investigated, since it is short, and simple enough for the patient to tolerate.

Treatment of bleeding episodes following previous operative measures or previously performed vascular shunts: Almost 15 years have passed since the application of veno-venous shunts for the relief of portal hypertension. New problems are becoming evident as experience accumulates. There are patients who rebleed after splenectomy, total gastrectomy, or any type shunt devised. With the failure of splenectomy and the spleno-renal shunt one access is denied. In fact it may be the only good shunt possible because of thrombosis of the portal vein or cavernous transformation. We believe that all of these patients should be re-explored and that the portal system be precisely delineated by a portaportogram. Some type of anastomosis, albeit definitely inferior to the portacaval or spleno-renal anastomosis, can usually be constructed between the general venous circulation and a dilated portal varix²⁷. We recently had a 14 year old boy who 4

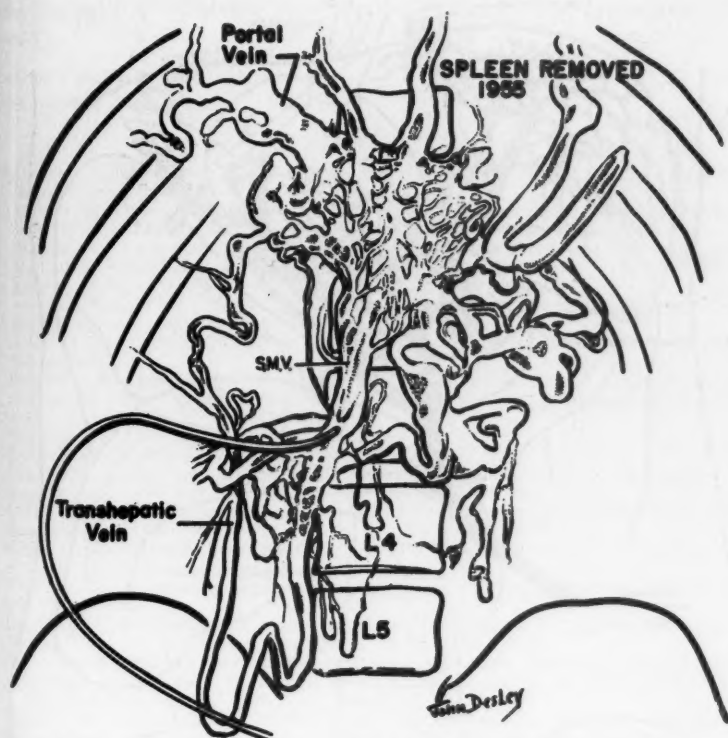
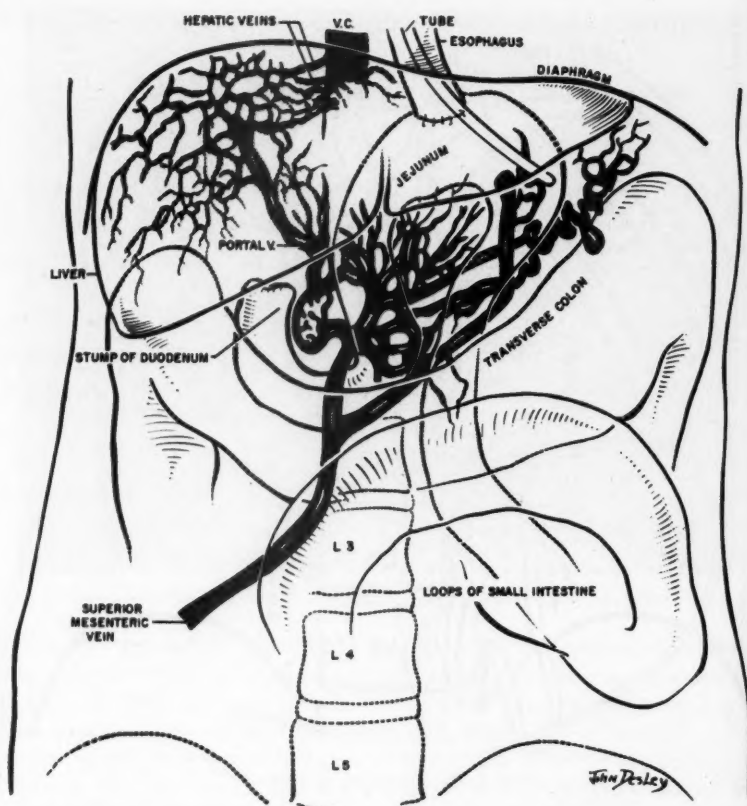


FIG. 3. Line drawing of figure 2

years before was splenectomized and a spleno-renal shunt was constructed. Massive hemorrhage recurred and it was necessary to perform emergency transesophageal ligation of varices followed by re-exploration of the abdomen 6 weeks later. Liver function studies indicated an extrahepatic type of portal bed block and a portaportogram performed at the time of the second procedure revealed cavernous transformation of all of the major veins of the portal system (Fig. 2, 3). The superior mesenteric vein which was our last best hope was involved. Anastomosis was finally accomplished between the inferior vena cava and a dilated portal varix about 1 centimeter in diameter which was fortuitously situated in the right free border of the gastro-hepatic omentum. To date he has done well. A similar situation was seen in a 16 year old girl who, at age 11, had a splenectomy and at age 14 a total gastrectomy in an effort to control bleeding from esophageal varices. Massive rebleeding occurred despite these procedures, and operative portaportagrams showed dilated jejunal veins anastomosing with esophageal veins at the site of gastrointestinal anastomosis (fig. 4). Since the



THE PORTAL SYSTEM VISUALIZED BY INJECTION OF UROKON THROUGH A JEJUNAL VEIN

FIG. 4. Portaportogram showing ramification of varices from the jejunum to the esophagus following total gastrectomy.

portal vein was patent a side to side portacaval anastomosis was performed in 1955 and she has had no bleeding episodes for 2 years. There is no definite course which can be recommended in these situations, but even a shunt regarded as less than satisfactory in an ideal situation, may prove a life saving maneuver.

CONCLUSIONS

Problems in the treatment of portal hypertension have been reviewed. A revised method for the use of esophageal tamponade is suggested. In the light of experimental and clinical evidence the side to side portacaval anastomosis is the procedure of choice for decompression of the portal system. Hepatic coma as a sequelae of complete portal diversion is discussed. Methods of operative treat-

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ment for patients rebleeding after previous vascular shunt procedures are presented.

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A LESS PAINFUL HEMORRHOIDECTOMY

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Hemorrhoids are the most frequent of anal disorders. Each year thousands of sufferers treat themselves or seek relief from all kinds of charlatans. The newspapers and magazines are guilty of promoting nostrums by running advertisements of "Wonderful Pile Cures without Surgery."

Physicians and surgeons are probably responsible for at least some of their patients seeking these treatments, by failure to do rectal examinations and by the general lack of interest. Also a great fear has been built up in the mind of the public, that hemorrhoidectomy is the most painful of all surgical procedures. No doubt some surgeons have justified this belief. Another popular belief is that the victim will lose all bowel control. These beliefs should be corrected by the physicians by giving and advising the correct treatment.

In recalling my own experiences and those of others in doing hemorrhoidectomies, this particular field has received less consideration, especially by the general surgeon, than any other part of the body. In fact, it has been abused in countless instances. To enumerate, and at the same time condemn, some of the methods of abuse, I shall name (1) avulsion of the anal sphincters with the fingers or instruments; (2) clamping large masses of tissue with large rough clamps; (3) burning or cauterizing, with hot irons; (4) unnecessary suturing and tying with all sorts of suture material from catgut to umbilical tape. All of these things traumatize sensitive tissues. Any of these, plus the removal of the great areas of mucous membrane and skin predisposes the patient to a painful convalescence, prolonged stay in the hospital, as well as a smaller calibre of his anal canal for the remainder of his life.

It occurs to me that less radical procedures are indicated; that perhaps the anus could be dealt with just as gently as the eye. Skin and mucous membrane that are necessary to cover areas on the other parts of the body are not cut away, why should they be cut away in the anal region? Or why should the tissues be traumatized to the extent that swelling occurs to make the anus look like a "doughnut" the next morning, with the patient in extreme pain and unable to pass his urine.

All so-called external hemorrhoids are not hemorrhoids at all, but are circumscribed blood clots outside a vein at the anal margin, and redundant folds of perianal skin. These extravasated blood clots are often referred to as external thrombotic piles, which is erroneous because the blood is outside a vein and in the loose areolar tissue. They are produced by the rupture of a perianal vein in the act of straining at stool, lifting or coughing. Such tumors present no problem as the clot can easily be evacuated under local anesthesia by simple incision.

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The true hemorrhoid or internal pile is the main item of this paper. A hemorrhoid is defined as a vascular tumor consisting chiefly of tortuous dilated veins accompanied by a branch of the superior hemorrhoidal artery at its termination in the submucosa of the anal canal just above the Hilton's white line.

Each hemorrhoid consists of a central artery, a mass of thickened tortuous veins and a varying amount of fibrous tissue, depending upon the length of time it has existed. The longer it has existed and the more it is subjected to inflammation, the more fibrotic it becomes, which explains the free bleeding early and less bleeding later. The accompanying artery is a branch of the superior hemorrhoidal, which is usually hypertrophied and it can be an active bleeder.

The number of hemorrhoids which may develop and their positions on the circumference of the anal canal is determined by the distribution of the terminal branches of the superior hemorrhoidal artery which is constant and gives rise from 3 to 7 hemorrhoids. The superior hemorrhoidal artery, after emerging from the pelvic mesocolon and while situated upon the posterior surface of the rectum, divides into two main branches, one for distribution to the right side of the rectum and the other to the left side. The right superior hemorrhoidal artery passes through the muscularis into the submucosa and divides into two primary anterior and posterior branches. The anterior primary branch does not give off secondary branches. It gives rise to the right anterior primary hemorrhoid which is always discrete and is not connected with any other hemorrhoid and it lies midway on the circumference of the right anterior quadrant.

The right posterior primary branch gives off an anterior secondary and a posterior secondary branch, making possible the formation of three hemorrhoids—namely the right posterior primary hemorrhoid located midway of the right posterior quadrant, and two satellites, the right secondary hemorrhoid located at the right point of the circumference and posterior secondary hemorrhoid located at the posterior point of the circumference.

The left superior hemorrhoidal artery passes downward through the muscular coats toward the anal margin along the line separating the left anterior and left posterior quadrants, the accompanying veins giving rise to the left primary hemorrhoid. This artery gives off an anterior branch and a posterior branch which give rise to the left anterior secondary hemorrhoid located midway of the left anterior quadrant and the left posterior secondary hemorrhoid located midway of the left posterior anal quadrant.

To recapitulate—there are three primary hemorrhoids and they are always found at the same relative positions—(1) the right anterior quadrant, (2) the right posterior quadrant and (3) the left point of the anal circumference. They are named according to their positions. In all cases of hemorrhoids about 70 per cent are of the primary vessels.

The secondary hemorrhoids are present in 30 per cent of the cases and are also located in the same relative positions—(1) the right, (2) the posterior, and (3) the left posterior quadrant and (4) the left anterior quadrant, and are named accordingly.

It is important to know this simple anatomy because it facilitates the group-

ing and excision of the primary hemorrhoid with its secondary satellites using the same ligature and at the same time conserving anal skin and mucosa. It will also enable you to defend yourself when a patient returns several years later with recurrence of symptoms from secondary hemorrhoids after operation for primary ones.

There are three stages of development of hemorrhoids—(1) primary, (2) intermediate and (3) final.

During the primary stage the hemorrhoid is small and is covered by healthy normal mucous membrane. It cannot be felt by the examining finger because of the compressibility of the dilated vessels which are not yet fibrosed. The only symptom it causes is hemorrhage which is repeated with each act of defecation.

As the development of the hemorrhoid progresses, it becomes larger and more elongated until it prolapses through the anal orifice at the time of defecation but reduces itself. It bleeds less readily because of the thickening of the mucosa and the fibrosis of the vessels. This is called the intermediate stage. The hemorrhoid can be detected by the examining finger at this stage. It can also be seen to protrude if the patient strains down. The final stage is reached when the tumor stays prolapsed or is retained with difficulty. The mucosa has become greatly thickened and often cornified. Bleeding is infrequent. All three stages of development may be present in a single case. The sentinal pile may be in the final stage, the right posterior primary hemorrhoid may be in the intermediate stage and the left primary hemorrhoid may be in the primary stage. The knowledge of this is important if the patient is expected to obtain a cure from surgery.

Indications for surgery in the treatment of hemorrhoids are—bleeding, pain and prolapse. Constant, prolonged, daily bleeding will render a patient severely anemic and correction is necessary. Hemorrhoids give rise to pain and discomfort due to the presence of the tumor mass and to ulcerations and fissures which accompany them. In such cases their removal is indicated. Prolapse interferes with the patient's comfort, and hinders pursuit of his occupation. Surgery is to be recommended. However, a great many hemorrhoids are symptomless. In such cases surgery is not urgent.

The technic for hemorrhoidectomy followed by less pain and fewer complications is simple. As stated in the definition, hemorrhoids are masses of tortuous dilated veins accompanied by a branch of the superior hemorrhoidal artery. The treatment then is the simple dissection of these masses of vessels only, ligation with a small calibre transfixing suture and excision.

The usual preparation for operation is carried out. The anesthetic of choice is a low spinal of 40 to 60 mg. of metycaine. I prefer metycaine as the agent, because it seems to be a more potent one, without an appreciable difference in toxicity, making it possible to obtain a longer and more certain action, at the same time using a smaller amount than could be employed by using procaine.

The patient is placed on the abdomen, the table is broken in its middle and the buttocks strapped apart with adhesive. This gives a much more comfortable position to the patient as well as to the surgeon than the old dorsal lithotomy position. The operative field is more accessible and the whole procedure is more

dignified. It makes it unnecessary for the nurses to leave the operating room while the orderly prepares the male patient, as has been the custom in many hospitals.

It is recommended that the operation be started with a visual examination of the rectum with a sigmoidoscope in order to discover an occasional cancer or other abnormal condition.

The hemorrhoid is grasped at the upper and lower end with Allis forceps. The mucous membrane and skin is incised on both sides at a point near the free border, and is peeled down toward the base with the sharp knife blade. The two Allis forceps will be left holding the mass of tortuous veins and a small amount of mucous membrane and skin. The veins are dissected upward and freed from the sphincters and the mucous membrane at the apex. The veins and artery are ligated high with a small transfixed catgut suture. Be sure of the latter because the artery retracts, and if it should bleed, it can be quite troublesome. Skin and mucous membrane in excess of the amount necessary to cover the raw areas are trimmed away and the operation is completed. No suture, whistle or gauze packs are used.

The next morning you will note that there is no doughnut-like swelling around the anus, the patient has not had more than one hypodermic of morphine and he is comfortable and can void. At the end of the third postoperative day a finger should be inserted to flatten out the mucous membrane and an enema given. At the end of a week or 10 days the wound will be healed without a change of the calibre of the anal canal, the patient will be happy and ever grateful for your kind and gentle treatment.

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AN IMPROVED METHOD OF ADRENAL DENERVATION FOR THE TREATMENT OF ESSENTIAL HYPERTENSION: RESULTS IN TWENTY PATIENTS FOLLOWED TWO TO SIX YEARS

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In previous publications,^{1, 2} I introduced an original method for denervating the adrenal glands and showed that this method was effective in 5 of 10 patients with essential hypertension followed from 1 to 4 years. The purpose of this paper is to present the latest technic for this procedure and a summary of 20 patients followed from 2 to 6 years with improvement in 80 per cent.

The success of this method depends to a great degree upon four factors:

1. Severing *ALL* the nerves to each adrenal by a careful systematized dissection under direct vision so as to avoid injury to the blood vessels.
2. Preventing the severed nerves from regenerating into the adrenals by the proper placement of Oxycel cotton (oxidized cellulose).
3. Selection of patients in whom the neurogenic element of hypertension is predominant as determined by a positive sodium amytal sleep test. The degree to which the blood pressure falls during deep sleep determines the approximate effect denervation of the adrenals will have.
4. Careful evaluation of the patient's cardiovascular-renal status. This requires the combined efforts of consultants in every case.

OPERATIVE PROCEDURE

Anesthesia. Endotracheal, combined with intravenous anesthesia, is preferred to insure a plentiful supply of oxygen, to minimize changes in blood pressure, to provide positive pressure if the pleura is punctured, and to eliminate psychic trauma. The anesthesia consultant makes the final decision and so far has used combinations of ether, nitrous-oxide and oxygen, and cyclopropane supplemented with intravenous pentothal, demerol and anectine.

Position. The patient is placed in a full lateral position with the eleventh rib forming the apex when the table is flexed to about 20 degrees. Stability in this position is maintained by 2 or 3 wide adhesive strips across the greater trochanter and anchored to the table top. Use of the kidney rest and adhesive strips across the chest have been abandoned because they interfered with free respiratory movements (fig. 1).

Instruments. Long handled instruments are essential because most of the dissection is performed at a depth of 6 to 8 inches. Deep hemostasis is more readily secured by applying metal clips rather than ties. Flushing of the adrenal area with saline removed by suction is preferable to gauze sponging because it is less traumatizing. The adrenal glands are friable and easily damaged and

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should not be grasped during the dissection even though it is very tempting to do so.

Technic. The operating time should be about 1 hour. The incision begins in the distal half of the eleventh interspace and extends anteriorly for about 5



FIG. 1. Full lateral position on table flexed 20 degrees



FIG. 2. The incision begins in the distal half of the eleventh interspace and extends anteriorly for 5 inches. Fingers mark ribs 11 and 12.

inches parallel to the eleventh rib (fig. 2). This provides better exposure and accessibility to the adrenal than an incision below the twelfth rib or resection of the twelfth rib. Any accidental opening of the pleura should be closed immediately while the anesthetist fully inflates the lung. If the peritoneum is accidentally or willfully opened it affords a splendid opportunity to palpate the adrenal through the rent, especially when a small tumor is suspected, and then is promptly closed.

After deepening the incision through the regional muscles the kidney is palpated. Then the superior pole of the kidney is exposed by separating the tissues with the tips of both index fingers under direct vision so as to avoid injuring important vessels in this location, namely, the inferior adrenal arteries which are branches of the renal arteries or superior renal polar arteries and the central vein of the left adrenal which usually empties into the renal vein in contrast to the right which usually empties directly into the vena cava and is found higher up. A portion of the lower edge of the adrenal can now be palpated and usually comes into view when the kidney is retracted gently downward and medially and the diaphragm upward so that the periadrenal fatty tissue is put on the stretch (fig. 3).

Additional retractors are then put into position for maximum exposure and the actual denervation is begun by carefully freeing the peritoneum from the anterior surface of the adrenal from below upward along its entire length to the diaphragm avoiding injury to the inferior phrenic vein. Just below the diaphragm, nerves can be seen entering the upper portion of the adrenal coming from the phrenic nerve and phrenic plexus (fig. 4). Using long handled hook dissectors, the nerves are distinguished from the vessels in the loose fatty areolar tissue and severed close to the adrenal. The vessels are preserved. The nerves

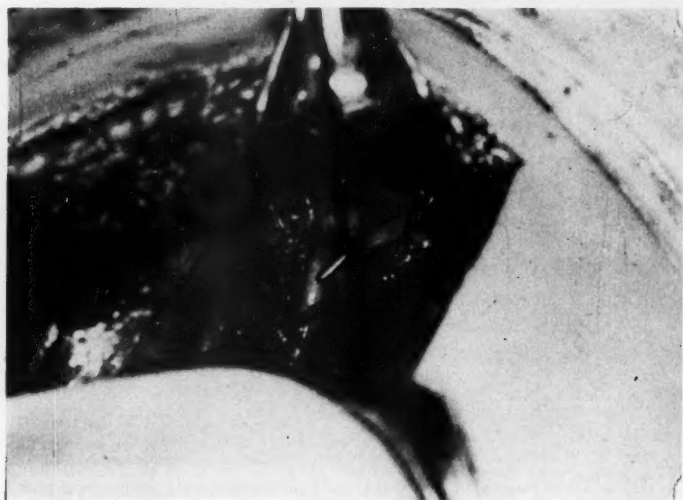


FIG. 3. Pointer on adrenal. Note blood vessels, upper pole of kidney to left and diaphragm above.



FIG. 4. Dissectors tensing several hairlike nerves from beneath diaphragm entering upper portion of adrenal just below. Compare with size and appearance of adjacent vessel.

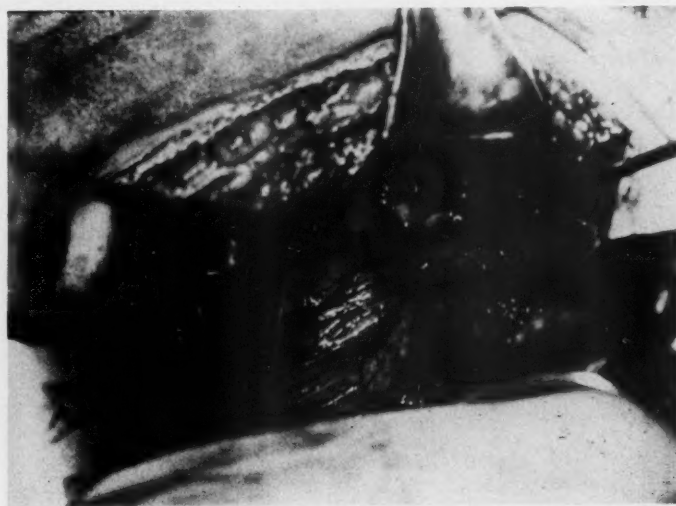


FIG. 5. Nerves entering posterior surface of adrenal which lies close to the retractor on left.

are very white and usually hairlike in size and tear readily when a slight tug is made on the hook dissector in contrast to the vessels which are thicker, somewhat colored, often visibly pulsate and are much more resistant to tugging. Differentiation is also aided by following the nerve or vessel away from the adrenal for an inch or so to its origin or leaving the controversial structure in-

tact until additional adjacent dissection proves helpful in reaching a decision. It is always embarrassing to have a "nerve" bleed freely after you sever it.

The dissection is then continued downward and from the lateral border medially along the posterior surface of the adrenal elevating the gland anteriorly and medially as the dissection and severance of nerves, coming from the coeliac plexus and the greater and lesser splanchnic nerves, progresses (fig. 5).

At this point the adrenal is fairly mobile and this aids in the denervation of its inferior portion where there are at least a dozen nerves of varying size coming from the renal plexus along with one or more arteries of fair size. This is the most accessible area to dissect but by no means the easiest due to the thickness of the perirenal fat in this location (fig. 6).

After completing this area, attention is directed to the final and most difficult region, namely, the medial border where a dozen or more nerves coming from the coeliac and aortic plexuses hold the adrenal snugly against the aorta on the left side and the vena cava on the right. On the left side it is better to dissect from above downward along the aorta toward the central vein. On the right side it is better to dissect from below upward along the vena cava until the central vein is seen and then proceed from above downward to the vein. On either side it is better to sever the nerves around the central vein last when all sides of the vein can be seen (fig. 7). This is particularly true for the right adrenal whose central vein is only $\frac{1}{2}$ inch long and empties directly into the vena cava thereby greatly limiting its movability. Trauma to the central vein resulting in ligation or thrombosis means necrosis of that adrenal. Only rarely is there an accessory vein and it is usually quite small in diameter.

By now the adrenal is quite mobile since it is held in place only by its blood vessels (fig. 8). A final inspection is made to make sure that ALL the nerves



Fig. 6. Dissector tensing one of several nerves entering lower portion of adrenal.

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FIG. 7. Dissector tensing a nerve going to medial portion of adrenal which is held elevated by another instrument. To left is central vein with fine nerves nearby. To right is a large adrenal artery coming from aorta below accompanied by 2 nerves along its left border.



FIG. 8. Denervation completed leaving blood vessels intact. To right of dissector is the central vein (now free of nerves as compared with figure 7), a small round accessory adrenal (which was removed) and 3 or more large arteries above.

have been severed and that hemostasis is complete. Biopsy, if desired, should be taken from an area that is not close to any blood vessels especially the central vein.

The completely denervated adrenal is then completely surrounded with a 1

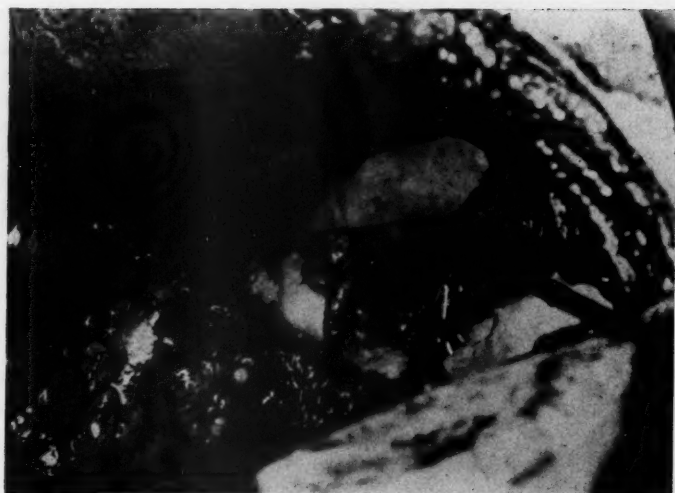


FIG. 9. All surfaces of adrenal have been covered with Oxycel cotton (1 in. thick) except the anterior which is covered last. Note two hemostatic clips marking site of excised accessory adrenal seen in figure 8.



FIG. 10. Anterior surface of adrenal covered with Oxycel. Top of kidney appears as retractor is being withdrawn.

inch thick layer of Oxycel cotton (oxidized cellulose) beginning with the posterior surface, then the superior, medial, inferior and finally the anterior surface, in that order. The cotton type of Oxycel is soft and compressible and can be readily placed between the blood vessels without compressing them (figs. 9, 10).

Autopsy findings,² as long as 2 years after denervation, show that this amount of Oxygel, although absorbable, causes the formation of a fibrous tissue encasement averaging $\frac{1}{2}$ inch in thickness which completely encircles the adrenals and is an impenetrable barrier to the regenerating nerves without impairing the blood supply. This makes the changes in the adrenals, produced by the denervation, lasting and very likely permanent. Microscopic examination of adrenal biopsies, taken at the time of both denervations, showed the capsule to be thickened, the cells of the cortex to be swollen and their characteristic cordlike arrangement to be indistinct. These same adrenals, 2 years later at the time of autopsy, showed a normal appearance in that the capsule was thin, the cells were no longer swollen and their cordlike arrangement had become prominent. In a similar manner, the adrenal medulla, at the time of denervation, showed numerous large cells and frequently seen nerves whereas 2 years later there was a normal distribution of the large cells and no nerves.²

A gauze filled drain is now inserted up to the diaphragm, the kidney is returned to its original position and the wound is closed in layers (fig. 11). Due to the large amount (3 or 4 tubes) of Oxygel, there is profuse serosanguineous drainage for the first few days requiring frequent changes of the dressing, then it lessens and becomes light brown with no odor. Cultures of this material have always been sterile. The drain is left in place for about 2 weeks so as to provide a tract for escape of this brown liquid caused by disintegration of the Oxygel. After removal of the drain the drainage gradually lessens and complete healing occurs usually in another 2 weeks. Prolonged drainage up to 2 months occurred in 6 instances.

Patients are permitted out of bed on the second or third day and leave the

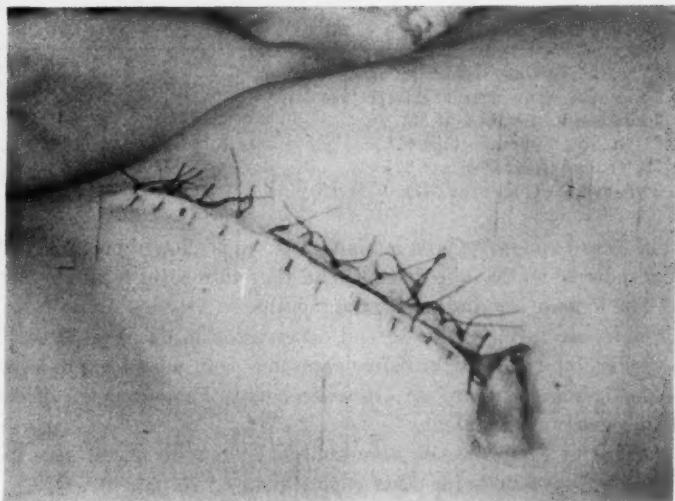


FIG. 11. Operation completed. Drain left in place for 2 weeks

TABLE 1
CLINICAL DATA

Summary Table of 20 Cases of Essential Hypertension Followed Two to Six Years After Bilateral Adrenal Denervation

Preoperative	
Age.....	23-65 yr.
Average.....	47 yr.
Sex.....	15 Female 5 Male
Duration of hypertension.....	2-30 yr.
Average.....	9 yr.
Ambulatory blood pressures frequently observed and arranged in diastolic sequence (one for each case).....	155/105, 175/120, 180/120, 180/120, 180/120, 180/120, 230/120, 180/130, 200/130, 220/130, 220/130, 220/130, 240/130, 200/135, 240/140, 270/145, 250/150, 250/150, 230/160, 260/165, 320/200
Symptoms.....	Headache and nervous tension
Fundi (Keith-Wagener).....	Grade I-3 II-10 III-4 IV-3
Sodium Amytal test.....	12 became normotensive (italics above) ... 60%
Postoperative	
Blood pressure.....	Improved in 16 cases 80% Normal without drugs 10 cases 50% Near normal without drugs 2 cases 10% Easier drug controlled 4 cases 20% Unimproved in 4 cases 20%
Symptoms.....	Improved markedly in 15 cases 75%
Fundi.....	Usually improved and never worsened
Adrenal insufficiency.....	2 cases (oral cortisone 25 mg./day) 10%
Nonsurvivals*.....	6* cases 30%

* 1 at 24 hr. due to congestive heart failure (age 49).

1 at 2 wks. due to myocardial infarct (age 53).

1 at 2 mo. due to uremia (age 36).

1 at 1½ yr. due to uremia (age 46).

1 at 1½ yr. due to strokes (age 62).

1 at 2 yr. due to strokes (age 47).

hospital in 10 to 14 days. At least a month interval is allowed before denervating the second adrenal so that the first has had time to recover from any operative trauma. The longest interim has been 6 months.

Cortisone is given during the second denervation in doses of 50 to 100 mg. twice a day beginning the night before operation, continued for 3 to 5 days and then gradually diminished to zero in several days. Prolonged use of cortisone has been necessary in 2 patients.

Other transient complications were atelectasis in 2 instances, ileus in 2 and tachycardia in 3. See table for other clinical data on 20 patients.

CONCLUSIONS

1. The systematic method of bilateral adrenal denervation described produces definite and lasting changes in the adrenal glands accompanied by a lessening of the neurogenic element in essential hypertension and its symptoms without causing undesirable side effects.

2. The best results from this procedure can be expected in the hypertensive patients whose blood pressure falls to normal or near normal during the sodium Amytal test regardless of the age of the patient or the duration of the hypertension.

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THE RECOGNITION AND TREATMENT OF SURGICAL LESIONS OF THE NEWBORN

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The vast majority of the surgical problems of the newborn are the result of congenital anomalies, and the system most frequently involved is the gastrointestinal tract. Other organ systems have congenital malformations, of course, but with few exceptions these are either nonsurgical or do not require treatment in the newborn period.

In order to understand clearly the nature of the anomalies which create surgical emergencies in the newborn some knowledge of embryology is essential.

The alimentary tract is originally a hollow tube, but because of epithelial proliferation of the mucosal lining early in the second month of fetal life, the lumen is completely filled, converting the tube to a solid cord. Later small vacuoles appear, increase in size, and coalesce to re-establish the lumen. If something interferes with development at this stage, one of three anomalies may result: one, atresia, with complete dissolution of continuity of the lumen of the gastrointestinal tract; two, stenosis, resembling a stricture; and, three, congenital diaphragm, which is best visualized as atresia of the mucosa with no interruption of the serosal and muscular coats of the bowel.

Since these lesions are congenital, they produce symptoms early, usually on the first day of life. It is important that the obstruction be corrected immediately, because all of these infants vomit, and aspiration of vomitus is a major cause of death in this age group.

These lesions may occur at any level of the intestine. They are statistically most common in the ileum, probably because it is the longest segment; per unit length, they are most frequent in the duodenum.

Congenital obstruction of the duodenum always causes symptoms shortly after birth. These babies often vomit before they are offered any feeding, and if the obstruction is below the ampulla of Vater, the vomitus will contain bile. The regurgitation of bile stained fluid is an ominous sign in a newborn, and usually indicates a surgical lesion. Many otherwise normal infants occasionally spit up or vomit, but rarely does the fluid contain bile in any quantity or for any length of time.

Vomiting appears early, but abdominal distension, if it occurs, is limited to the epigastrium and disappears after vomiting. The passage of grossly normal meconium stools may be misleading. Meconium is formed throughout the length of the intestinal tract, and since only a short segment is obstructed, there may be an almost normal quantity of meconium passed at the usual time. Micro-

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scopic examination of the stools will reveal the absence of lanugo hair and cornified epithelial cells if the obstruction is a complete one, but this is usually of academic interest only.

The diagnosis can be readily established with a single erect roentgenogram of the abdomen, which will reveal the double bubble of congenital duodenal obstruction. The stomach and proximal duodenum will be filled with swallowed air but there will be no gas in the remainder of the abdomen. Further studies with contrast material are unnecessary, for the exact mechanism of the obstruction need not be established before operation.

The specific type of lesion need not be demonstrated at surgery either. The duodenum is relatively fixed and inaccessible, and because of the close proximity of the common and pancreatic ducts, the pancreas, and the superior mesenteric vessels, extensive dissection is inadvisable. The usual treatment is to by-pass the obstruction, preferably by side to side duodeno-duodenostomy or duodeno-jejunosomy.

Obstruction of the remainder of the bowel is relatively easy to diagnose. Vomiting may not occur quite as early as in the case of duodenal obstruction, but abdominal distension and tympany will appear shortly after birth. Meconium may be passed but will vary in quantity with the level of the obstruction. Roentgenogram will reveal gas-fluid levels in the dilated proximal bowel. Again, it is not necessary to determine the exact level or mechanism of the obstruction preoperatively. At surgery, the lesion is usually resected and an end to end or end to side anastomosis made.

In operating on any infant for intestinal atresia, it is imperative that a thorough abdominal exploration be done, for many of these patients will have multiple areas of atresia or other congenital anomalies of the gastrointestinal tract.

Another cause of intestinal obstruction in the newborn period is meconium ileus which is usually associated with mucoviscidosis, or cystic fibrosis of the pancreas. In the absence of the normal pancreatic enzymes the meconium is very thick and tenacious and cannot be propelled normally through the intestine. It causes a complete obstruction, usually in the mid- or terminal ileum, and is often indistinguishable preoperatively from atresia of the small bowel. The infant with this disease vomits and becomes distended early and fails to pass meconium. Roentgenograms of the abdomen will show dilated loops of small bowel, usually without fluid levels, and granular, inspissated meconium mixed with small bubbles of gas, actually resembling adult feces. Treatment is directed toward relieving the obstruction, but the results are discouraging, because the patients are later subject to respiratory infections or nutritional disturbances. At surgery it may be necessary to resect the portion of bowel plugged with meconium, because it is difficult or impossible to remove it from the lumen.

A lesser degree of meconium ileus is meconium constipation, which may occur in otherwise normal infants or in patients with atresia of the small bowel. The meconium constipation stool forms a cast of the distal colon and may not be expelled without the aid of an enema.

Because the peristalsis of the fetus is weak and inactive, perforation of an obstructed segment of intestine is rare, even though obstruction is complete and of long standing. It does occur occasionally and the escaping meconium, although sterile, causes a severe chemical peritonitis. An infant with meconium peritonitis may be born with an abdomen so distended as to cause dystocia. This is not a gaseous distension, since the infant has had no access to air, but results from the out-pouring of large quantities of peritoneal fluid in response to the chemical irritation. Roentgenogram of the abdomen may show scattered calcification, which is pathognomonic of this condition. At surgery it may be impossible to relieve the obstruction resulting from the many dense adhesions. Occasionally, when complete exploration is possible, no cause for the perforation can be discovered. Prognosis depends on the extent of the peritoneal adhesions and on the general condition of the infant at the time of surgery.

To return for a moment to embryology—the gastrointestinal tract is originally a hollow tube which runs straight through the body of the fetus. During the second month of fetal life the alimentary tract grows proportionally faster and can no longer be contained within the peritoneum. As a result of this disparity in growth, the intestine herniates out into the base of the umbilical cord. This hernia is normally spontaneously reduced by the tenth week, but if development is interfered with, it may persist until birth. The resulting omphalocoele is not covered by skin but by peritoneum and amnion, two very thin transparent layers. If it is not corrected immediately, drying and rupture of the sac occurs, with resultant evisceration, peritonitis, and death.

Sixty per cent of the patients with omphalocoeles will have other anomalies, and half of these anomalies will be malrotation. Embryologically speaking, this is to be expected. When the fetal umbilical hernia reduces spontaneously, the alimentary tract has become too long to maintain its straight path through the body of the fetus, and it follows an orderly course of rotation. The duodenum bends toward the left, posterior to the superior mesenteric artery, and loses its mesentery to become fixed to the posterior abdominal wall. The cecum and ascending colon turn toward the right, anterior to the superior mesenteric artery, losing the mesentery and becoming similarly fixed. Should this normal rotation fail to occur, the ascending colon and occasionally the duodenum will retain a mesentery and fail to become attached to the posterior abdominal wall. Obviously if the bowel remains outside the abdomen in an omphalocoele, the normal rotation and fixation will not occur.

This rotation involves primarily the midgut—that portion of the intestinal tract which is supplied by the superior mesenteric artery, that is, from the duodenum to the middle of the transverse colon. In malrotation, the only point of attachment of the mesentery of the midgut is the origin of the blood supply. When such a long loop of bowel has such a narrow fixation, volvulus can readily occur, resulting in a closed loop obstruction.

Another mechanism of intestinal obstruction resulting from malrotation occurs from an abnormally high fixation of the cecum. If the cecum only partially

rotates and remains in the upper abdomen, bands of peritoneal adhesions form from the cecum across the duodenum to the posterior abdominal wall. Duodenal bands resulting from malrotation usually produce symptoms in the first few days or weeks of postnatal life. Vomiting is early and frequent, but meconium stools are normal. Roentgenograms will reveal a dilated stomach, a gas-filled duodenum, and a normal amount of gas in the remainder of the abdomen.

The surgical treatment is nearly identical for the two forms of obstruction resulting from malrotation. The adhesions are divided or the volvulus reduced, then the entire colon is placed on the left side of the abdomen and the small bowel on the right. By this maneuver recurrent obstruction is prevented.

Annular pancreas is another congenital anomaly that produces intestinal obstruction, but here the symptoms may not be manifest until late childhood or early adult life. The embryologic defect has its origin at about the same time as the preceding anomalies of the intestine. The pancreas arises as two separate buds from the duodenum. Normally both buds fuse on the posterior aspect of the duodenum, but occasionally the ventral anlage grows across the anterior surface before it unites with the dorsal anlage. In this manner, a ring of pancreatic tissue comes to surround the second portion of the duodenum. The diagnosis is made preoperatively by demonstration on barium meal of the rather long circumferential constriction of the duodenum at the level of the pancreas. Recommended treatment consists of bypassing the obstruction by duodeno-duodenostomy or duodenojejunostomy. The pancreatic duct may be in any portion of the pancreatic ring, and division of the ring may result in pancreatic fistula.

So much for congenital anomalies. Other conditions commonly seen in the newborn period are those resulting from birth injuries, and most of these are fractures or intracranial damage that do not require surgical treatment. One birth injury that might require surgery is rupture of the liver, which rarely occurs in infants under 7 or 8 pounds. The pathology usually consists of ruptured subcapsular hematoma without actual laceration of the liver. It is to be suspected in a newborn infant who suddenly goes into shock without apparent cause and proved by obtaining blood on peritoneal tap. Surgical repair is difficult, because the capsule may be stripped from the surface of the liver. For this reason conservative treatment is sometimes recommended, reserving surgical intervention for those infants who fail to respond to transfusions.

Rupture of the stomach is occasionally seen in the newborn period. Whether it represents perforation by a misdirected tracheal catheter, perforation of an acute peptic ulcer, or partial absence of the muscular coat of the stomach cannot always be determined. Regardless of etiology, it causes vomiting, abdominal distension, and paralytic ileus. Roentgenograms will reveal the presence of pneumoperitoneum, frequently massive. Treatment obviously consists of closure of the perforation, either by simple suture or by plugging with a bit of omentum. The prognosis will depend largely on the general condition of the infant at the time of surgery.

SUMMARY

In summary, it can be stated that surgical problems of the newborn most frequently involve the gastrointestinal tract and most often consist of congenital anomalies. Roentgenograms should be taken on any baby who vomits, particularly if the vomitus contains bile. With a high index of suspicion, the mortality of intestinal obstruction in the newborn can be drastically reduced by early diagnosis and treatment.

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SURGERY OF THE SOFT TISSUES IN HAND INJURIES

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TECHNICAL CONSIDERATION

The effort of repair of the small structures of the hand requires a continuous strain on the fingers of the surgeon in order to prevent additional trauma to the already injured tissues. It has been the experience of many surgeons that operative technics on the hand without rest for the elbows and forearms of the surgeon, produces not only a diminution of efficiency due to early fatigue of the muscles of the arms, forearms, and fingers, but also creates an actual change in his meticulous operative skill. One of the basic principles in obtaining a fairly good atraumatic technic is relaxation. However, the surgeon's hands and fingers can never relax unless the elbows and proximal forearms are allowed to rest in a stationary position. For this reason any operating room where hand repairs are made must have a device that achieves not only a rest for the patient's arm at right angles to the long axis of his body but also a place where the surgeon's elbow and forearm may rest while working. There should be a space where the trunks of both surgeon and assistant may approach near the operative field. Curtis³ suggested a rectangular board cut to desired dimensions, the regions between the middle and distal thirds of which contain semicircular cutout spaces at both sides to accommodate the trunks of the assistant and the surgeon near the surgical field. It is further advisable that the surgeon and assistant sit well balanced on a stool beside the board.

Debridement of devitalized tissues is a familiar subject. It should be emphasized, however, that tissue that is not dead should never be sacrificed.

All denuded surfaces should be covered as soon as possible. Repair of hand injuries unless obviously superficial and small should be done in the operating room. Avulsions of skin occurring on the dorsum of the hand may be grafted with split thickness grafts from the skin of the thigh. A sliced wound at the tip of the finger can be grafted immediately with a piece of skin taken from the volar surface of the forearm near the wrist. This can be obtained by means of a sharp single edged blade and then sutured to the edges of the wound at the tip of the finger, leaving the stitches long. Fine no. 0000 silk is recommended. The long ends of the stitches are then tied over a wad of sterile dry gauze to provide pressure and dressing at the same time. The stitches may be removed within a week. With patients with a finger amputated, for example, the distal half of the thumb, a cross-finger flap from an adjacent finger may be used to cover the raw surface of the amputated stump. Cross-finger flaps may be applied not only on ends of amputated fingers but also to denuded sides of adjacent fingers.

This paper was entered in the Scientific Award Essay Contest of The Southeastern Surgical Congress, 1957.

SURGERY OF THE NAILS

Hematomas may occur under the finger nail during crushing injuries such as when the fingers are caught in a car door. Roentgenograms should be taken when indicated to rule out fractures of the phalanges. Nail drilling as a procedure for drainage in subungual hematomas is satisfactory only when small collections of blood are present. When the hematomas are fairly large, drilling of the nail is of little value because the holes soon become clogged. It is often advisable to use a thin-bladed knife such as a cataract knife inserting it between the nail and the nail bed until the hematoma drains.⁶ When a nail is detached proximally at its base leaving the distal portion intact, it is wise to trim off the detached portion leaving the intact distal portion untouched, the raw area being dressed with vaseline gauze. The nail matrix is tough in consistency and can remain viable even when completely detached or avulsed if adequate suturing is employed to approximate it with the surrounding skin. When the matrix's proximal portion is avulsed at the nail root, it can be sutured under the overlying skinfold in an overlapping mattress manner, the stitches being anchored on the outside of the skinfold, the matrix tunneling itself for a short distance beneath the skinfold itself.

During the process of regeneration of the nail, a split nail may be formed. This is due to adhesions between the nailwall (lateral skinfold) and the middle portion of the matrix. To avoid this, it is often at the end of 2 weeks necessary to pass a fine probe beneath the nail to break the adhesions. This is kept open by alternate day probing until the process of adhesion formation has been counteracted.

SURGERY OF THE TENDONS

Tendon lacerations form the brunt and gamut of most of the problems encountered in the repair of the injured hand. A lacerated nerve may be over-

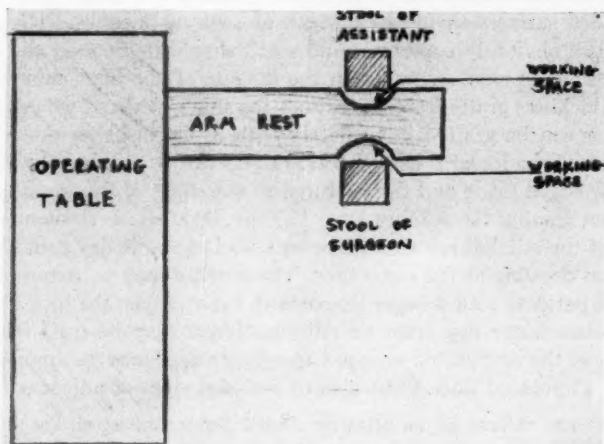


FIG. 1. Top view of operating table outfit for hand surgery (after Curtis)

looked and left unrepaired and by virtue of the neurotactic properties of its cut ends, union and eventual function of the axons may ensue. The tendon on the other hand needs a careful and near anatomic apposition. Lacerations of tendons at the region of the wrist or at the proximal third of the palm are not difficult to repair. It is, however, the laceration of tendons from the region just proximal to the transverse palmar crease distalwards that gives the surgeon the maximum difficulty during repair.

Two schools of thought exist on the subject of tendon repair following trauma. Pulvertaft and Littler believe that in a given laceration of the hand involving the deeper structures, the nerves must be repaired, the skin sutured and the tendon left unmolested. They believe that the repair with the possibility of a tendon graft should be done 6 weeks later.³ They reason that in any primary tendon repair, the healing stage is always accompanied by adhesions with consequent immobility of the tendon in the sheath, hence a subsequent procedure usually becomes necessary. Bunnel, Kock, Mason and Swiss² on the other hand advocate primary tendon repair on all tendon injuries not more than 6 hours old, with discretion on those from 6 to 12 hours old and no primary tendon repair on injuries more than 24 hours old and on those that are obviously contaminated. They believe that primary repair of tendon minimizes not only infection, but also saves the tendon and surrounding structures from unnecessary scarring. The prevailing method followed by the primary repair group is divided into two stages. Stage I consists of a thorough primary tendon repair under the best facilities of the operating room followed by immobilization with a cast or especially devised splints for 3 weeks. Stage II consists of a recheck 4 months from the time of repair. If there is little or no progress in extension or flexion, a tenolysis is performed. This can be accomplished easily by graded tendon strippers. It has been observed that in the delayed repair group, extensive

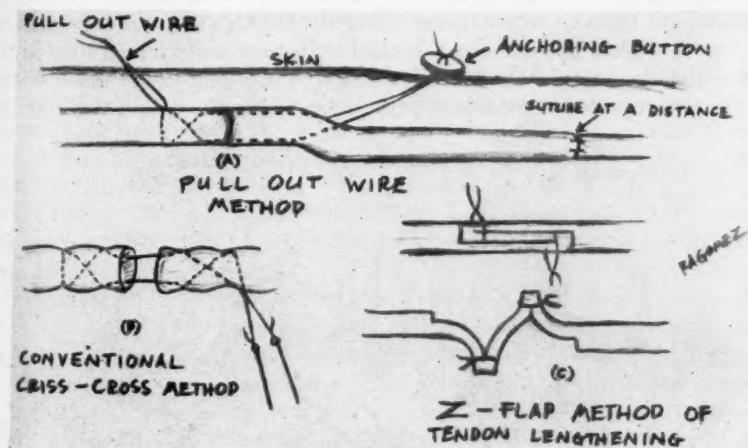


FIG. 2. Examples of tendon repair

scarring of the wound results after 6 weeks so that identification of structures is difficult and the surgeon in most instances has to remove an extensive scar. Consequently, repair cannot be done satisfactorily due to loss of tissue after excision of the scar. Invariably, moreover, tendon graft does not hold as satisfactorily as end to end approximation.

One important structure along the tendon sheaths which many surgeons frequently overlook in tendon repair is the pulley system which acts as leverage for high functional efficiency of the tendon during its gliding motion in the sheath. There are two such pulleys in a finger. The larger and proximal pulley consists of a transverse fibrous band extending from the metacarpal head to about $1\frac{1}{8}$ inches on the proximal phalanx. The small pulley measures about $\frac{5}{8}$ of an inch and is located at about the middle of the second phalanx. When these structures are transected, the motions of the tendons lose their strength and efficiency. Thus, they should be reconstructed when identified. In tendon injuries where the tissues have a tendency to swell after trauma, the proximal pulley may be partially slit at one side during tendon repair to avoid postrepair pressure which very often endangers circulation and tissue nutrition. In some instances, proximal partial bilateral slitting of the pulley facilitates the flexing action of the tendon at the metacarpophalangeal joint which cannot otherwise be achieved due to an insufficient angle of motion.

Most surgeons use silk in suturing tendons for the reason that it is handy and readily available in most hospitals. In general, silk should be untreated because knots of treated silk tend to slip and untie. Silk used for repairs (as in the case of flexors) should be of the smallest size to withstand a 3 pound pull. During the last few years, the use of stainless steel ranging from no. 34 to no. 36 has been in vogue as advocated by Bunnell² and Curtis³ respectively. Thirty-four gauge wire is very handy in the pull-out wire method devised by Bunnell. He uses stainless steel to approximate the ends of lacerated tendons, the distal extremities of the wire sutures being pulled out through the skin and anchored to a button while a pull-out wire is hooked to its proximally buried loop in the tendon and also brought out through the skin. Thirty-four gauge stainless steel wire may be used to anchor a lacerated tendon end to the nail of the finger by

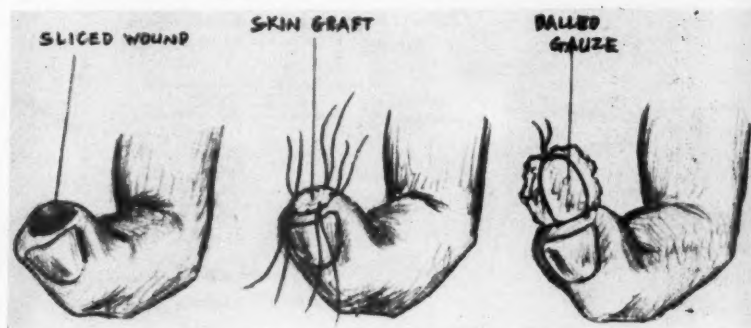


FIG. 3. A method of skin graft to a fingertip

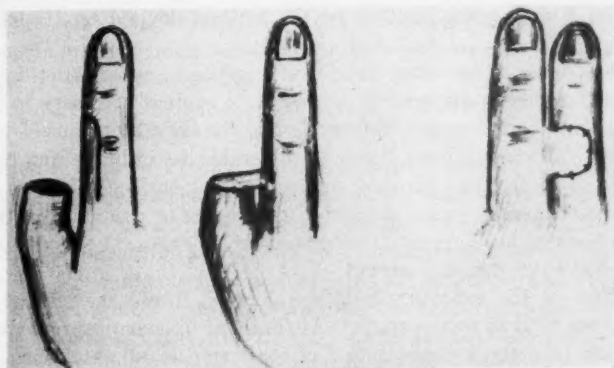


FIG. 4. Cross finger flaps

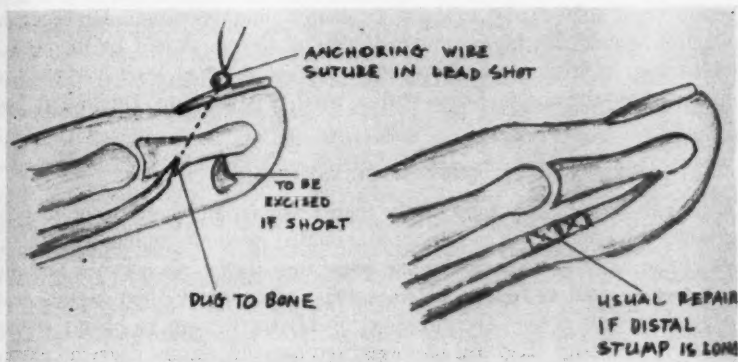


FIG. 5. Tendon laceration near the distal end

passing the suture through the distal phalanx and fastening it to a lead shot on the surface of the nail. A portion of the phalanx may be incised for adapting the proximal tendon end. The distal stump of the tendon, if less than $\frac{3}{4}$ of an inch in length may be excised rather than leave it functionless. If the distal stump is more than an inch long, a primary suture should be done. Curtis³ uses no. 36 wire in the usual tendon repair. It has more tensile strength and causes less tissue reaction than silk or cotton. Pull-out wire sutures are usually left in place for a period of 3 weeks.

In patients with both the sublimis and profundus transected, it is usually wise to sacrifice the sublimis and repair the profundus because the former may limit the range of motion of the latter after scar formation in the tendon occurs. When conditions permit, an incision should be made a good distance proximal to the point of excision and the sublimis pulled out for subsequent removal. When a severed tendon cannot be approximated without tension, a tendon graft, or tendon lengthening procedure either with the running stainless steel

method,² the Z sliding flap method, or the method devised by Hibbs¹ may be used.

Meticulous repair of lacerated sheaths of tendons to avoid stricture is advisable. When the sheaths are severely damaged, it is often necessary to interpose a gliding surface for the tendon between it and the bone by means of paratenon tissue or fat. This specialized tissue is preferable to ordinary fat because it doesn't cause adhesion and provides a better gliding surface. This can be taken from the subcutaneous tissue around the forearm or around the tendon of Achilles. A rectangular piece can be obtained and interposed between the tendon and bone where the sheath is absent.

Transection of the extensors is a less complex problem. Severed exterior tendons do not tend to gap or retract. At times, as in lacerations on the dorsum of the middle phalanx, immobilization of the finger in full extension is all that is necessary. Occasionally approximation may be made with figure of eight removable stainless steel wire sutures.

Tendon repairs should be followed by ample immobilization. However, immobilization should not be overdone. Repair of flexors should be followed by immobilization in flexion, with a dorsal plaster splint for at least 3 weeks.⁴ Immobilization may be accomplished with a volar plaster splint, the fingers being left free.

SURGERY OF NERVES

Nerves can be repaired more easily than tendons, and because of their less retractable behavior, they can be approximated without undue tension. The nerves of the hand are peculiar in the sense that they have a faster and more regenerative as well as functional restoration after injury than nerves nearer the central nervous system. Terminal peripheral nerves seem to have a stronger regenerative tendency than highly specialized nervous tissues near the cerebrospinal axis. Nerve fibers in the hand and fingers are seldom mixed motor and sensory nerves. They are motor or sensory alone, hence adequate functional restoration is the tendency after satisfactory repair.

As in the example of tendon injuries, there are proponents of primary and secondary nerve suture. Woodhall and Seddon,³ both advocates of secondary suture believe that in hand injuries the skin and tendons must be repaired while the nerve should be left untouched. Relying upon its regenerative power, nerve repair may be done 4 to 6 weeks later after an almost complete self approximation of the nerve ends have taken place. Bunnell, Kock, and Masson, however, contend that extensive scarring and considerable loss of function may take place if a nerve is left unrepaired for weeks. They therefore advise careful primary suture and eventual neurolysis 6 weeks later. A lacerated nerve that has not been thoroughly approximated may develop unnecessary scarring and reduce its functional capacity. Nerves are usually sutured with very fine silk including only their sheaths and not their component fibers, otherwise some degree of motor or sensory disturbances may occur. Interrupted sutures are best applied by bridging the line of transection. It is often useless to attempt

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suturing of nerves distal to the second phalanx because of their small size. They usually repair in accordance with neurotactic phenomenon, especially when the finger is immobilized in extension.

SURGERY OF THE BLOOD VESSELS

Major vessel injuries of the hand are rare in civilian life. Most often small vessel injuries of the fingers or palm are encountered distal to the transverse crease. Each finger has at least 4 digital branches running along it (except the thumb), two coming from the superficial volar arch and two from the dorsal carpal arch.⁶ The common arterial supply of the thumb comes from a branch of the deep volar arch, the princeps pollicis.⁸ The landmark for determining the level of the superficial volar arch is the proximal transverse palmar crease with the thumb extended. The deep volar arch is slightly proximal.

Small arterial bleeding in a laceration can be stopped instantly by application of a sterile straight clamp on the severed ends preliminary to thorough cleansing and eventual repair of the wound. Due to abundant anastomosis in the hand, ligation of either the ulnar or radial arteries may be done without jeopardizing circulation.⁶ However, ligation of a major artery at the wrist should not be resorted to except when necessary. Ligation of a major vessel higher up in the forearm is better tolerated than that of a major vessel in the wrist. Before ligating any single principle artery, it is advisable to ascertain the adequacy of collateral circulation.

If arterial anastomosis is undertaken, bleeding should be controlled by bulldog clamps applied proximally and distally. Number 00000 Deknatel silk on an atraumatic needle is advised⁷ using either the continuous Carrel method or the everting mattress suture.⁵ Venous injuries are treated by ligation. Elevation of the part is indispensable after vascular surgery. Anticoagulants are recommended. The application of heat is contraindicated.

SUMMARY

The technical problems of repair of injuries to the soft tissues of the hand are discussed.

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EDITORIAL

TOWN VERSUS GOWN

Town-gown conflict in the field of medicine is no new problem. From the beginnings of modern medicine, especially since the advent of full time clinical teachers, some degree of hostility has been experienced by nearly every medical school and university hospital in the country. This sort of antagonism, however, has never been more widespread or acrimonious than at the present time, or more harmful to educational programs and medical public relations.

Apparent issues are teaching hospitals, private practice and income of "full time" faculty members, and role of private practitioners in medical education; the real issues are more personal and selfish ones—financial interests, prestige, competition, and control.

Half a century of experience in modern medical education has demonstrated beyond question the great advantage, if not the necessity, of a teaching hospital closely associated with the medical school, under professional control of its faculty. Virtually all medical schools in America now have their own university hospitals, or affiliated hospitals that function in that capacity. On the whole, these hospitals are not viewed with favor by local private physicians. Full time faculty members (if one may be permitted to generalize) insisted that they can do better jobs of education and research and can maintain higher standards of clinical work in hospitals under their immediate direction than would be possible under any other arrangement, but most of them are blithely unaware that this attitude implies an air of superiority that is offensive to colleagues in private practice. Full time teachers also take it as a matter of course whenever university hospitals provide them with convenient private patient facilities without overhead costs. On the other hand, private physicians in the community view the university hospital as being to some extent in competition with private hospitals, and full time faculty members as enjoying unfair advantages in competition with themselves. As they see it, this competition has been sharpened by extension of sickness insurance to a large proportion of the population and the diminishing numbers of purely charity cases in teaching hospitals. Sensitive private physicians feel excluded by the closed staffs of the university hospitals. Many of them feel that they and their work are "looked down on" by persons in the "ivory tower", and this assumed slight to prestige doubtless accounts for many instances of retaliation in kind and for opposition of many sorts.

Generally speaking, "full time" clinical faculty members receive income either (A) entirely from salaries, or (B) partly from salaries and partly from private patient fees. In the former category, such private patient fees as are collected go to the institution to support its program. In either case, the institution benefits financially—the university hospital from the private hospital fees and the medical school because its salary budget is supplemented, directly or indirectly, by patient fees. Some full time teachers who are academic purists

prefer to receive all of their income from salary (provided it is adequate) and do not wish to be bothered by private practice; the majority, however, prefer to receive part of their income from private practice because it is financially advantageous to do so, because they enjoy practice and wish to preserve some degree of personal doctor-patient relationship, and because they feel that they can be more effective teachers and producers of private practitioners if they maintain first-hand contact with that type of activity. But neither Plan A nor Plan B is fully acceptable to private physicians in the community. They criticize the first as "unethical institutional practice of medicine" and the second as unfair competition with private practice in general. This dissatisfaction has expressed itself variously, from friendly discussions to uncompromising antagonism. In some localities, the conflict has been avoided to some extent or has been lessened by adoption of restrictive policies, such as limitation of private practice of full time faculty members to patients specifically referred by practicing physicians, ceilings on private practice income that may be received personally by the full time faculty members, time restrictions such as limiting practice to one-half day a week, or by the appointment of liaison committees to handle complaints. But all too often the fires of discord have been fanned, on the medical school side by indifference to the problem, and on the practitioners' side by such extreme measures as boycotting the institution, campaigns of derogatory criticism, or (in the case of state schools) interference through legislative channels.

There is need for more open recognition of this whole problem, both locally and on a national level. Attempts should be made to find common grounds of agreement. Fair-minded, reasonable people should be able to agree on such basic tenets as these: The highest possible grade of medical education must have first priority in any consideration. Teaching and research hospitals under professional control of medical school faculties are essential to good medical education. Such hospitals should have sufficient clinical material for teaching purposes, even though they may be supplemented in this respect by affiliated hospitals. Full time faculty members should receive compensation appropriate to their abilities and responsibilities and work load, and should not be penalized financially for pursuing academic careers. Ideally, this remuneration should be equivalent to the net income those individuals might be expected to receive in private practice or in industry. Although medical schools and university hospitals should be strictly nonprofit institutions, they should also receive enough income from whatever sources may be available to operate efficiently with balanced budgets.

Even if these fundamental principles should be agreed upon, other controversial matters would remain to be settled before full concord could be achieved. What role should interested and qualified private practitioners have in undergraduate medical education? How can they be suitably recognized and rewarded for effective, self-sacrificing services of that sort? How can the wealth of clinical and pathologic material in nearby private hospitals be used more effectively for undergraduate teaching? Is it really *unethical* for an institution to obtain

needed financial support by collecting fees for professional services of its salaried medical personnel, or is that simply a violation of an arbitrary rule set up to protect particular group interests? Although there have been abuses here as in many other areas, is it true as a general rule that private practice by full time faculty members constitutes unfair competition with private practitioners? Does restriction of private practice of full time faculty members to patients referred by their "competitors" (private physicians) make for unfair competition in the other direction? How does the "sacred" principle of free choice of physicians by patients apply here?

Modern medicine is a vast and complex field. The health and welfare of 160,000,000 people in this country, the incessant production of well trained physicians and medical scientists, the expanding need for high grade research in countless areas, and many sorts of organizational activities, altogether constitute an enormous task. This task is the joint responsibility of medical people of all kinds—practitioners, educators, investigators, health officers, trainees, and administrators. Each group and each individual has a responsible part to play. The over-all task is tremendously difficult. That would be so even if complete dedication of effort and cooperation could be achieved. Success in this common effort will be wanting, however, to the degree that medical men and medical groups dissipate their energies, waste their powers, and demean their profession by fighting each other. Although every individual has rights and privileges, they should be secondary to the good of the people as a whole. Although medical groups and organizations have proper self-interests, they are less important than the work and best interests of the profession as a whole. It is a sorry business whenever progress and effective medical work are hampered by fraternal strife, especially when those clashes arise from avoidable misunderstandings, or from prejudices and self-interests. More positive, concerted, fair-minded approaches to existing and potential town-gown conflicts and tensions are indicated. Full cooperation and bilateral good will are lofty ideals; they are also very practical goals.

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BOOK REVIEWS

The editors of THE AMERICAN SURGEON will at all times welcome new books in the field of surgery and will acknowledge their receipt in these pages. The Editors do not, however, agree to review all books that have been submitted with solicitation.

The Recurrent Laryngeal Nerves in Thyroid Surgery. By WILLIAM H. RUSTAD, M.D., publisher, Chas. C Thomas, Springfield, Illinois.

This 47 page monograph presents the very limited subject of the extralaryngeal anatomy of the recurrent laryngeal nerves. The anatomic findings from 100 cadaver dissections (hence 200 nerves) are presented in a very excellent manner. Eighty-seven drawings showing varied artery, nerve, and thyroid relationships are presented. Each drawing is accompanied by a descriptive text.

Several notable facts are demonstrated from this study. Forty-three per cent of the nerves had divided trunks. There was no consistency of pattern between the right and left sides. To the best knowledge of this reviewer, this monograph represents the most extensive single study performed in this field. Careful study of this material by those performing or contemplating thyroid surgery is highly recommended.

ROGER D. SCOTT, M.D.

The Philosophy of Medicine. By WILLIAM R. LAIRD, M.D., Education Foundation, Inc.

This 64 page nontechnical medical book presents the philosophic teachings of William R. Laird, Doctor of Medicine, Doctor of Science, Doctor of Literature, etc., and also a noted West Virginia surgeon. The collection of this material was urged by Dr. Laird's friends and associates who had heard his philosophies and observed his actions and reactions. The book is divided into five chapters dealing with logic, esthetics, ethics, politics, and metaphysics. The comments are very appropriate and applicable to the daily experiences encountered in the practice of medicine. The text offers excellent reading, not only to physicians, but to all persons involved in medicine. This book offers excellent basic reading for medical students and to all others who possess an earnest desire to professionally, ethically, and morally improve themselves.

ROGER D. SCOTT, M.D.

Kerr's Operative Obstetrics. By J. M. M. KERR, M. D., under the direction of J. Chassar Moir, M. D., Baltimore, Maryland, The Williams & Wilkins Company.

The Sixth Edition of Kerr's Operative Obstetrics is under the sole editorial direction of Professor J. Chassar Moir, Nuffield Professor of Obstetrics and Gynecology, University of Oxford. Prior to this edition, joint editorial direction was shared by Dr. Moir and by Dr. Monroe Kerr, who is now retired from active professional life.

Naturally enough Kerr's influence is felt in this text as in the previous editions when he guided the text through approximately 40 years of existence and through five previous editions. However, under the direction of Dr. Moir this edition now takes on a very personal approach to the problem of operative obstetrics. I find that the many references in the first person add considerable enjoyment to the perusal of a text which has already proved itself in the past, for Dr. Moir is an accomplished writer as well as being one of the most accomplished obstetricians in the United Kingdom today.

The book reads easily and the layout of material is excellent. A rather vast fund of historic information is included and adds to the general enjoyment of reading. The illustrations are generally excellent, and while there are only four color plates in this nearly 1000 page edition, the quality of color and reproduction is good.

The habit of placing the reference at the bottom of each page is a refreshing change from most American texts. Much broader in its scope than the title would seem to indicate, the book presents a scholarly discussion of all obstetrical abnormalities which may lead to operative interference. The references to manipulative obstetrics with the patient in the Simm's position are, of course, of general interest only rather than of practical value to obstetricians practicing in the United States.

The format is good. The material is excellent and the binding is of better than average quality. For these reasons I would not hesitate to recommend this text as a very valuable reference edition for obstetricians, those doctors doing a good deal of obstetrics, and residents in their latter years of training. I do not believe that it would be of value to students. But for those in the categories previously mentioned, Kerr's Operative Obstetrics would be an enjoyable and very valuable edition to their literary armamentarium.

L. LOUIS MOULD, M.D

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